AVIATION WEEK

The Eighteenth Annual INVENTORY OF AIR POWER

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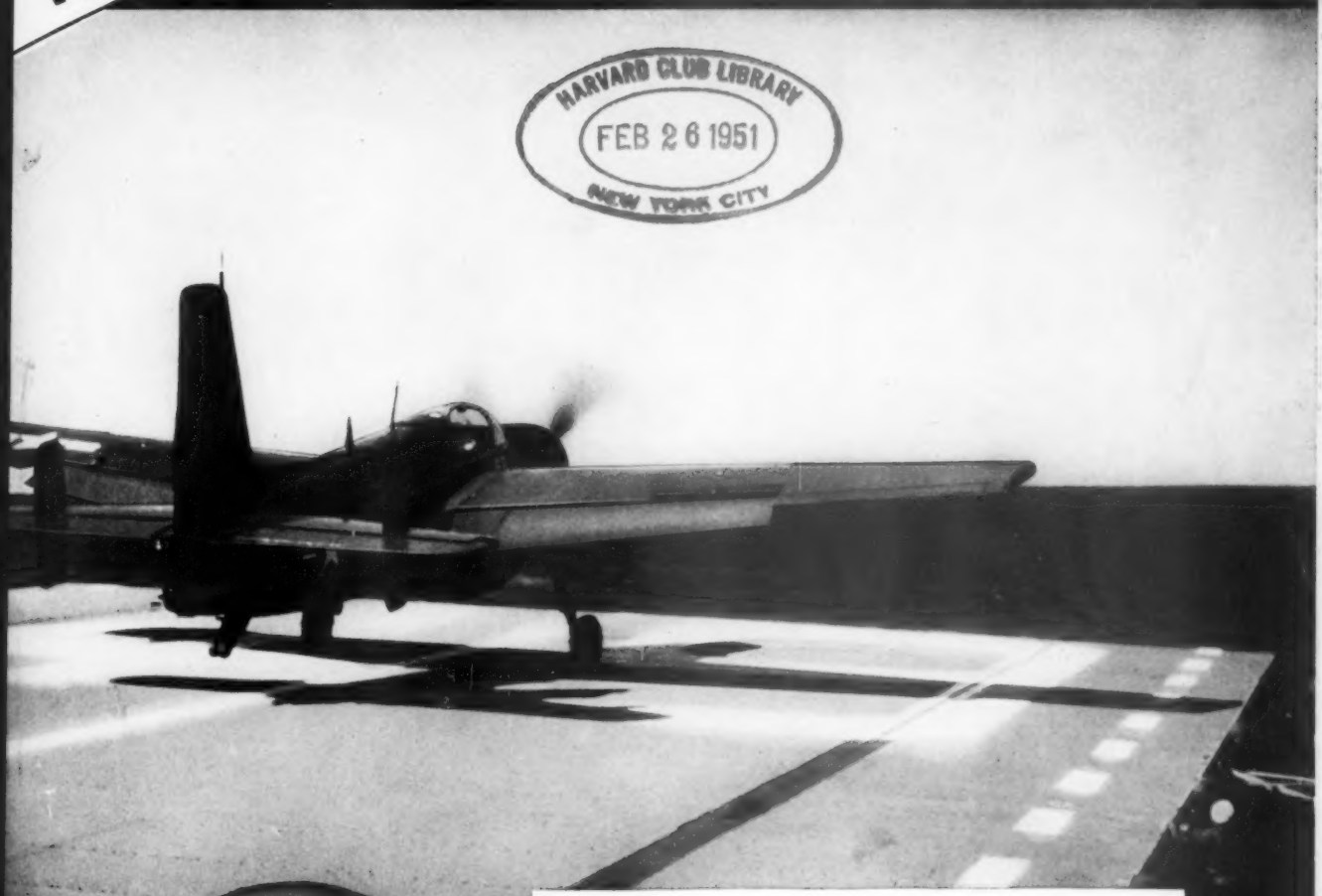


Grumman

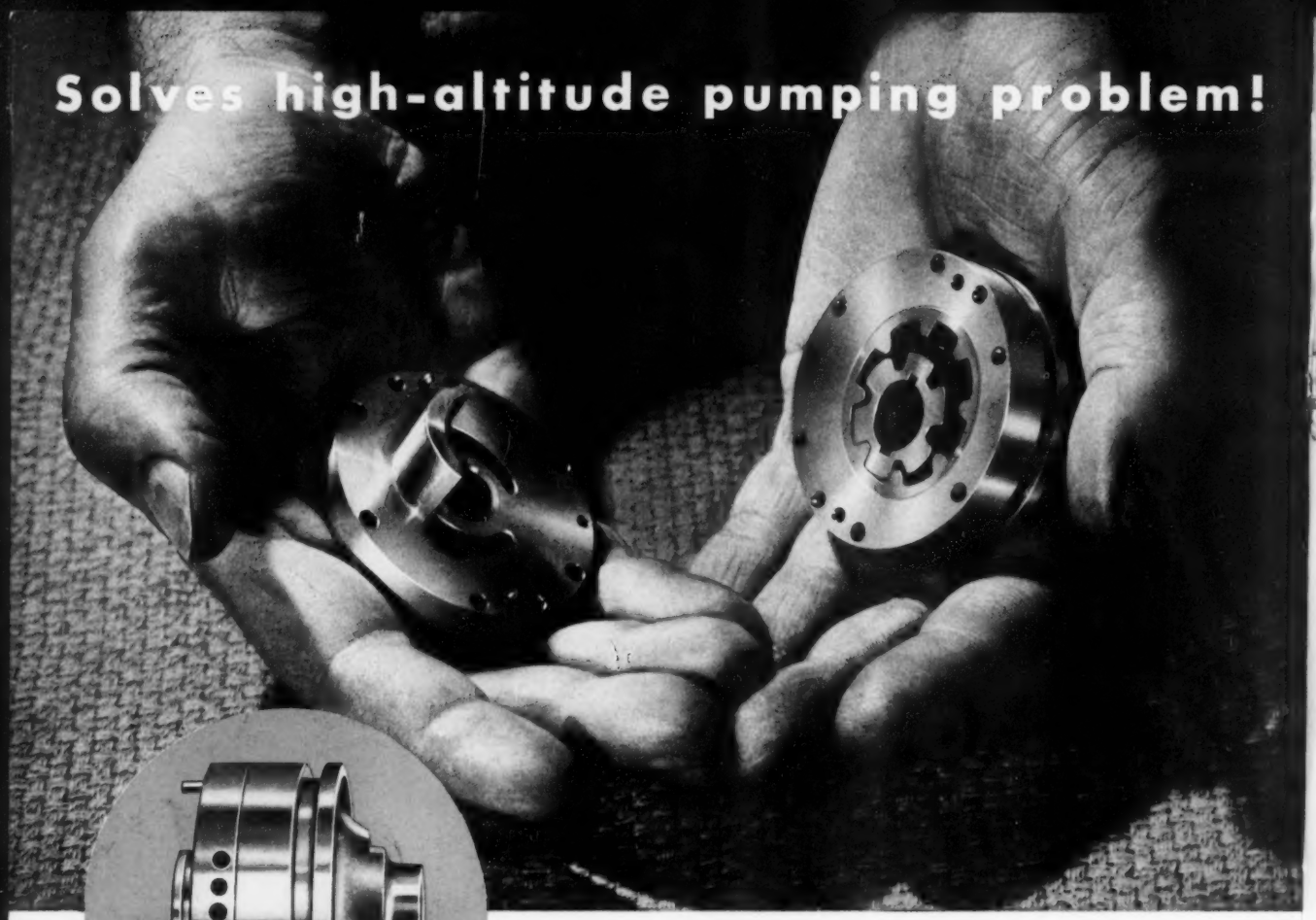
Navy's New Sub Hunter

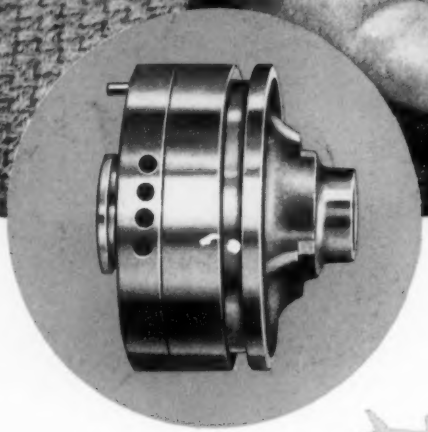
About to take off from its carrier deck is a GRUMMAN GUARDIAN, a plane designed to find and destroy enemy submarines. Some GUARDIANS, of which this is one, are equipped with long range detection devices. Others, lighter on radar but heavier on bombs, come in to make the "kill." True to their name, these versatile carrier-based aircraft serve as round-the-clock guardians of the fleet.

GRUMMAN AIRCRAFT ENGINEERING CORPORATION, BETHPAGE, LONG ISLAND, NEW YORK

Contractors to the Armed Forces

Solves high-altitude pumping problem!





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B.F.Goodrich

Hotter heating pad keeps boom on the beam

THE FLYING BOOM, Boeing's new development for in-flight refueling, has to fly straight to its mark from tanker to bomber. Even near misses are out.

One big problem stood in the way of the boom's operating "on the beam" during the refueling operation. Ice, forming on the vee-shaped ruddevators that control the boom's flight, would throw accuracy for a loop.

Boeing engineers decided to make the leading edge of the ruddevators so hot that water droplets hitting it would evaporate before they could freeze. They knew that B. F. Goodrich had developed electric rubber to concentrate heat at the spots where heat was needed. The question they put to BFG engineers was whether the rubber could supply more intense heat and still stand up in service.

To answer this, B. F. Goodrich came up with an electric rubber pad built with a new, high temperature flexible material. It has a core of resistance wires that carry higher power to produce more heat.

Used on the Air Force's new prototype Boeing KC-97A tanker, the BFG electric rubber pad keeps ice from forming on the Flying Boom, makes accurate control possible.

Standard-construction B. F. Goodrich electric rubber is doing a successful anti-icing job on airplane wings, propellers, air intakes, jet cowls, hydraulic lines, water tanks and many other aircraft parts. The new high-temperature construction offers advantages where extreme heat is needed.

If you have an icing problem—or any other that rubber might solve—get in touch with the leader in rubber research and engineering—B. F. Goodrich. *The B. F. Goodrich Company, Aeronautical Division, Akron, Ohio.*

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Aviation Week

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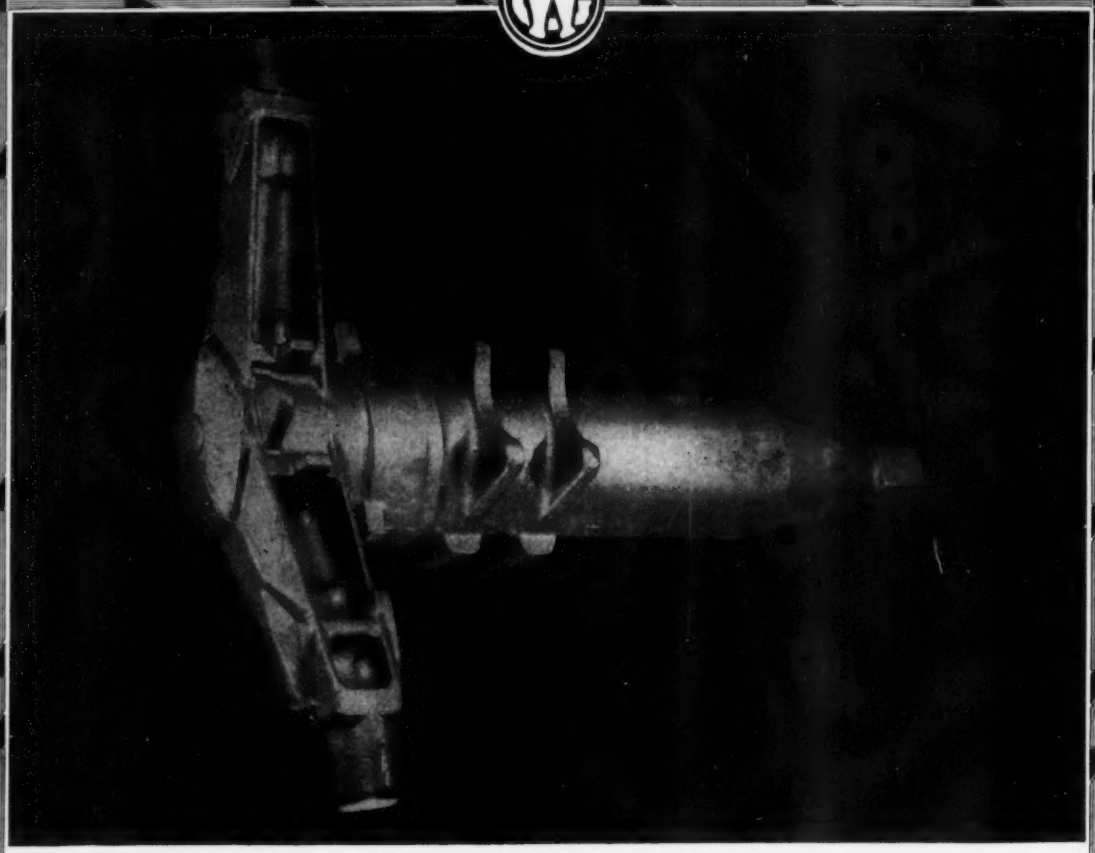
SIKORSKY

11 YEARS

FAFNIR

The dependable performance of Sikorsky helicopters under severe conditions has earned rotary wing aircraft a permanent, indispensable role in modern commercial, military and naval operations. Such performance is the result of many factors. It is significant that Fafnir Ball Bearings have been used by Sikorsky for 11 years. Something more than good ball bearings is responsible for this long association. It's the Fafnir attitude and aptitude . . . a way of looking at ball bearings from the designer's side, an aptitude gained from more than twenty years' specialization in aircraft ball bearings. The Fafnir Bearing Company, New Britain, Connecticut.

Fafnir Ball Bearing designed for rotor cyclic pitch control . . . one of the Fafnir Ball Bearings regularly specified by Sikorsky. Plya-Seals keep grease in, contaminants out, insuring long service life and uniformly low torque.



Forgings for the aircraft industry today demand the utmost in engineering and production techniques and in scientific laboratory control. This massive complicated landing gear component, weighing over 400 pounds, is typical of Wyman-Gordon's forging contribution to the ever-growing progress in aircraft design.

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AVIATION CALENDAR

Mar. 8-9—Eastern regional meeting, Institute of Navigation, Shoreham Hotel, Washington, D. C.

Mar. 12-13—Short course on uses of aerial equipment in agriculture, Purdue University, West Lafayette, Ind.

Mar. 16—Sixth annual flight propulsion meeting, Institute of Aeronautical Sciences, Hotel Carter, Cleveland.

Mar. 19-23—Seventh Western Metal Exposition, Oakland Auditorium and Exposition Hall, Oakland, Calif.

Apr. 16-18—Society of Automotive Engineers aeronautic and aircraft engine display, Hotel Statler, New York.

Apr. 19-21—Airport Operators Council annual meeting, Hotel Peabody, Memphis, Tenn.

Apr. 24-26—ATA annual engineering and maintenance conference, Hotel Drake, Chicago.

May 12-13—Airlines Medical Directors Assn. eighth annual meeting, Hotel Shirley Savoy, Denver, Colo.

May 13-14—Airline Medical Examiners Assn. fourth annual meeting, Hotel Shirley Savoy, Denver, Colo.

May 14-16—Aero Medical Assn. 22nd annual meeting, Hotel Shirley Savoy, Denver, Colo.

May 17-19—Annual convention of the Women's Aeronautical Assn. of the U. S., Little Rock, Ark.

June 11-15—Second annual conference on industrial research, conducted by Columbia University Dept. of Industrial Engineering, New York.

June 13-16—Aviation Writers Assn., convention, Hotel Commodore, N. Y.

June 15-July 1—International aviation display, Grand Palais and Le Bourget Airport, Paris.

June 18-22—Private seminar on organization and operation of company standardization work, to be held by Dr. John Gaillard, Engineering Societies Bldg., New York.

June 18-July 6—Three-week Air Age Institute course, Parks College of Aeronautical Technology of St. Louis University, East St. Louis, Ill.

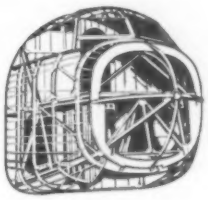
June 25-29—1951 summer general meeting of the American Institute of Electrical Engineering, Royal York Hotel, Toronto.

Sept. 7-11—Third annual Anglo-American Aeronautical Conference, convened jointly by Royal Aeronautical Society and IAS, Brighton, England.

Oct. 3-6—Society of Automotive Engineers aeronautic and aircraft engine display, Hotel Statler, New York.

Oct. 31-Nov. 1—Society of Automotive Engineers fuels and lubricants meeting, Drake Hotel, Chicago.

RUGGED



CHASE planes are designed and built to withstand severe landing shocks on short or unprepared fields, providing maximum safety to cargo and crew.

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AVIATION WEEK VOL. 54, NO. 9
FEBRUARY 26, 1951

Staff Analysis of Air Power

Industry Is Our Strongest Weapon

U. S. PRODUCTION CAPACITY must pull North Atlantic air power back to its conquering strength of World War II. It will be an uphill pull.

Europe's undenied industrial potential is several years away from being a major factor. Meantime, our manufacturing machine has to rebuild not only our own air strength, but that of our allies.

U. S. military aviation—Air Force and Navy—is stronger than a year ago, will grow rapidly from now on. Even right now, it could be a potent fighting force. That is not true of the air forces of our allies.

On the other hand, Russia is not ready to contest our supremacy in long-range strategic air war.

Those are some of the conclusions reached by the AVIATION WEEK staff after sifting the mass of material assembled in this country and abroad for this Inventory of Air Power.

•

OUR MANUFACTURING INDUSTRY is the best weapon the U. S. has. It is so good it doesn't have to be a "secret weapon." It has demonstrated twice in three decades that where the weight of U. S. production goes, victory goes, too.

Now, U. S. industry is getting ready for a third demonstration—if necessary.

And it gets off to a far better start than in 1940–41.

There is more and better trained manpower. There is far more plant production area.

There are nearly 400 reserve plants, most of them new, built as recently as World War II. All that means less time lost in getting ready for full mobilization—if that ever becomes necessary.

•

GOVERNMENT IS STARTING EARLIER and more effectively on its build-up than it did the last time war looked possible. Whether by accident, or because the lesson actually was learned, planners are following closely recommendations made to the Air Coordinating Committee after a study of aircraft production acceleration in World War II: license and subcontract.

Already, the large automotive manufacturers have been given key roles in increasing aircraft and engine output. Already, major airframe manufacturers are being put to work turning out other firm's planes.

This licensing program draws on the total U. S. industrial might. It takes longer to get production this way. But in the end you get higher production.

Subcontracting is mushrooming. You can't get precise figures; but subcontracting volume will reach a "peacetime" high.

•

U. S. AIR FORCE and Naval Aviation strength today has to be examined with this in mind: the better military forecasters in the Pentagon aren't looking for real trouble before 1956.

In numbers of planes and manpower, today's Air Force and Naval air arm are a long way from their World War II zenith, and a long way from national security.

But, individually, pilots now fly much more deadly war machines faster, in most cases farther, and hit their targets more accurately.

You can say the same for the bombers. There still are not enough late-model B-36s in operation to mount a strong offensive. But the B-29-types that are the backbone of the Strategic Air Command, are vastly improved and have another great plus: aerial refueling.

The Navy has at last awakened to the fact that subfighting is as important and sound a reason to build a strong air arm as it thought strategic bombing was two years ago.

The new "super-carrier" will launch the planes for the anti-submarine war. It is not primarily for strategic bombing. The latter is still USAF's activity.

Money is no longer a problem for either service. Everyone is resigned now to annual defense expenditures exceeding $50 billion. And USAF is getting more than the other two services.

•

PUSHBUTTON WAR? Not yet, but in the foreseeable future for some types of missiles.

Best estimates seeping from behind the wall around guided missile development is that for the next eight or ten years the main U. S. stake will ride the noses of the strategic bombers jockeyed to success or failure by human pilots.

In less time, guided missile interceptors, launched from piloted planes, probably will succeed the present interceptor techniques. The transition from piloted to pilotless weapons will be gradual.

Some missiles already are part of U. S. air power. They are in production, or soon will be. Establishment of the Office of Guided Missiles headed by a production expert, K. T. Keller, of Chrysler, was the tip-off.

(*News of the Week on Page 205*)

RESEARCH DETERMINES THE FUTURE of our air power. We might be able again to overwhelm an enemy with quantity as in some respects we did in World War II. But that's a risky gamble.

It is safer to bank on qualitative as well as quantitative superiority. That's why research and development are in a hey-day never before experienced.

We are rich in two of the three requisites of research: money and machinery, although not in men.

But we have lost much time. During the war we sacrificed much basic research to get better results from what we had. That was development rather than research. After the war, research budgets were too lean for several years.

Time is an ally of research. We can never make up what we've lost.

•

WE ARE FAR STRONGER IN TRANSPORT potential than ever before. The Military Air Transport Service has 370 four-engine transports. U. S.-flag airlines own more than 500, airlines of friendly nations have more than 200.

We had to build a military air transport fleet from scratch during World War II.

It is not only the planes now operating that makes the transport air power picture so encouraging. There are nearly 300 transport-type planes on order from U.S. manufacturers.

These on-order planes alone have more airlift capacity than the entire 1946 airline fleet.

The size of both the MATS and the airline fleet has this significance: in case of war, there would be no requisitioning such as last time curtailed the effectiveness of the airlines. Airline planes will be chartered as needed. Planners think about 50 percent of the airline fleet would be needed for military purposes.

Even with 50 percent of their planes under military charter, the airlines feel they could handle about 75 percent of present record business.

•

FOREIGN AIR POWER of nations friendly to the U. S. will not be of much help in any immediate military action.

This is a matter of both lack of production and inferior technology. Devastated by war, European nations have had to have a "butter instead of guns" economy.

Europe's concentration on improving its standard of living has been its intangible but great contribution to the anti-Communist drive. Now Europe is being called upon for the direct contribution: defense production.

The nations are moving, but slowly. No European government dares lower the standard of living very much. Communism might win by default.

And defense production means a lower standard of living. No European country has enough funds for the result to be otherwise.

All over Europe, night fighters are in demand. Sweden and France, as well as Britain, are pushing development of night fighters and, meanwhile, counting on the U. S. to make up the lack.

•

CANADA IS THE BRIGHT SPOT in the North Atlantic Treaty picture. Next to this country, the Dominion will be the largest producer of aircraft for the NATO countries in the immediate future.

Avro Canada's CF-100 all-weather fighter likely is the equal of anything on this side of the border and sometime this year should get into large-scale production.

Canada's production of trainers will be substantial. And Canadian production of the F-86 will be a major factor in meeting European demand.

•

MUTUAL DEFENSE ASSISTANCE PROGRAM is lagging, despite the recognition that without it NATO falls apart.

As had been expected, the problems of military aid to allied nations are involved, and complicated by international red tape and national jealousies. And much of this can be laid at the doors of our own military officials and the Congress.

MDAP can be set up for any nation, but it is under the supervision of the North Atlantic Treaty Organization. Naturally, at this stage, NATO is more interested in Europe. Not much is going or will go for some time to other parts of the world.

You can't argue too much with that. Europe has the potential industrial capacity that will be of most help, when and if it can be put to work.

But there has been some solid progress under MDAP. Already Britain and France both have received numbers of fighters. The program will steadily increase this year and by Fall about half a billion dollars worth of aircraft and spares will have moved to Europe.

•

RUSSIA IS NOT PREPARED for offensive air war. That is the only logical conclusion to be drawn from the evidence.

Remember, fighters are defensive aircraft. The Soviet's excellent stable of jet fighters means merely this:

Russia has been preparing to defend itself from strategic bombing. If you accept that analysis, the next conclusion is easy—that Soviet military planners have recognized the value of strategic air war.

And this is a fundamental switch in Russian military thinking.

Russia is just starting to build its long-range striking force. That's encouraging. The U. S. has a five- to ten-year lead in the mastery of heavy, long-range planes. That gives the diplomats time to work out a peaceful solution.

(*News of the Week on Page 205*)

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Military Aircraft Appropriations & Expenditures—1946-51*

(Millions of Dollars)

Fiscal Year	AIR FORCE				NAVAL AVIATION				TOTALS	
	Total Oblig.[1]	Total Expend.	Airc. Oblig.[1]	Airc. Expend.	Total Approp.	Total Expend.	Airc. Approp.	Airc.[2] Expend.	Airc. Oblig. & Approp.	Airc. Extend.
1946	5,420.5	8,775.8	393.2	240.0	922.4	N. A.	91.3	N. A.	484.5	240.0[3]
1947	3,144.4	2,993.0	477.5	370.7	808.7	782.4	307.9	259.8	785.4	630.5
1948	3,634.4	3,011.2	1,641.6	630.6	749.0	735.1	329.2	108.6	1,970.8	739.2
1949	3,399.8	3,613.3	731.2	601.6	1,338.0	875.0	738.7	312.8	1,469.9	914.4
1950	4,729.5	3,402.2	1,656.9	1,269.1	1,068.4	969.3	663.0	440.0[3]	2,319.9	1,709.1
1951	14,319.2[4]	6,510.3[5]	6,616.0[4]	1,858.2[4]	3,400.0	N. A.	2,534.7	N. A.	9,150.7	1,858.2[3]

* Military aviation expenditures for the years preceding 1946 are listed on page 41.
[1] Air Force funds are on the basis of obligations in order to conform to the period when its funds were part of the Army appropriation.
[2] Air Force only.
[3] $142 million withheld by the Secretary of Defense.
[4] Including the Second Supplemental to the Fiscal 1951 appropriation.
[5] To January 31, 1951.

Sources: U. S. Air Force.
Naval Bureau of Aeronautics.

With Money No Problem, Strength Grows

More funds, effort given air defense are bringing about balanced power.

By Ben S. Lee

U. S. air power, the most formidable weapon of World War II, is on its way back to hugely expanded status after a dangerous interlude of comparative impotence.

But realization came almost too late to our government and its allies that appeasement of the Russian Politburo in its quest for world domination is useless. Abrupt awakening came with a series of shattering jolts to the complacent U. S.: the Soviet atomic explosion; increased tension in Germany; the fall of China to the communists and the subsequent deterioration in Southeast Asia and the Philippines; and finally open aggression in Korea. Now, at last, the call went out for greater air power.

Room to Grow

After World War II the U. S. Air Force sank with dangerous rapidity both in quality and quantity of planes as an economy-minded President and Congress slashed the military budget in 1946-7.

Real crisis in state of readiness of the Air Force came two years ago, when, with some 56 groups activated but not completely equipped, it was ordered to cut back to 48 groups—actually a lesser force than Air Corps mustered at the time of Pearl Harbor.

At the 1949 year-end, the Air Force had 3300 firstline combat aircraft, comprised of 15 heavy bomber groups, 27 light bomber and fighter groups and six troop carrier groups.

Navy fared no better. At the end of calendar year 1949 the Navy operated 13 carriers and could claim only 1212 aircraft as being "firstline," although it held 3368 aircraft of all types as operational equipment.

▶ **Time to Save**—Even as first drafts of proposed budgets for fiscal 1951 were drawn, still more drastic slashes in the military economy were scheduled despite advices of top military and civil leaders. The lawmakers and one or two top military leaders were concerned only with the fact that the last war had cost this nation $340 billion and that come what may it was time to economize.

The last half of the fiscal year 1950 closed on a grim note—war in the Far East. A worried and rudely awakened Congress hastily okayed Presidential requests for a 1st and 2nd Supplemental Budget to stiffen the nation's defenses.

▶ **Time to Spend**—By Jan. 5, 1951 the Air Force had committed $4,945,919,888 of all funds appropriated thus far for aircraft and related procurement. Of that amount, it had obligated $3,609,728,761. Of funds appropriated for research and development activities $139,095,534 had been committed and $73,543,132 was obligated. By Feb. 5, USAF had committed 90.4 percent of all procurement funds, approximately $9.25 billion, and obligated 61.4 percent.

Naval Aviation procurement also is moving swiftly. Procurement status reported Jan. 12 indicated that of $3,002,469,000 appropriated for construction of new aircraft, spares, research and development activities, etc., $1,805,709,000 had been committed and $1,456,855,000 of this already had been obligated.

Army Aviation procurement, insignificant dollar-wise in fiscal 1951—$40 million—sets an important precedent. For the first time since the Air Force gained autonomy, Army Ordnance has entered the aircraft procurement field. In fiscal 1952, funds appropriated for Army will include a vastly-expanded budget for aircraft peculiar to Army requirements.

Building Allies

Mutual Defense Assistance Programs of the North Atlantic Treaty Organization, lagging early in 1950, are still far behind the programmed schedules of its operation.

Deterrent to a more rapid acceleration of MDAP is the political red-tape inherent when governments of nations must agree on fine points of the working machinery of a program international in scope.

Most important factor contributing

to slow-down of MDAP is the extremely poor public information concerning activities, scope and aims of MDAP.

▶**Secrecy vs. Education**—While much of the plans of the NATO group and its related MDAP must remain closely guarded for security of the NATO nations, a high defense official admitted an educational program of the workings of NATO is to be instituted. He deplored a recent statement of a U. S. MDAP official that the American public is not to reason why; just foot the bill.

Basic strength of Western Europe lies in its huge industrial capacity—still greater, according to official sources, than that of Russia and its satellites. Its weakness lies in inadequate army, navy and air forces. Politically, Western Europe generally suffers from weak morale.

To speed rearmament of Western Europe, in keeping with North Atlantic Treaty Organization agreements, the western group will concern itself mainly with air transport and special emphasis on tactical aviation. This is in addition to other factors of military defense.

Revised fiscal year 1950 estimates of financial defense potential for treaty nations was set at $18,326,000. But these funds were virtually frozen to expenditure on basic commodities only and provided no real assistance to the building of industry.

▶**More Money**—Legislation provided for in the overall fiscal 1951 budget boosted these funds to $475 million. Most important to North Atlantic Treaty Nations in new legislation was the fact that this money could be spent in actual industrial rehabilitation.

Of the $475-million total, Defense Department estimates approximately $110 million is allocated for rebuilding and expanding treaty nations' aircraft industries. Production potential as a result of that expenditure is estimated at approximately $607-million worth of tactical aircraft, and engine production of approximately $64 million.

Estimates being programmed at the Department of Defense also provide for meeting deficiencies in all activities relating to air power. Major emphasis is to be given industries developing radio, radar and wire communications, ammunition, bombs, rockets, machine guns. Parallel procurement is planned for motor transport and special purpose vehicles for aircraft refueling and operations.

▶**More Planes**—To meet the more stringent material needs of nations of the North Atlantic Treaty, USAF and Navy are transferring some of their World War II aircraft. Both services have ample quantities of piston-engine fighters and light bombers in storage throughout the U. S. and in Europe. By December, 1950 the Defense Department had already shipped some 600 aircraft under MDAP to NATO nations.

Republic F-84 jet fighters now in use by USAF both in England and in Germany are scheduled for transfer to England and France late next spring. Their transfer will be effected as soon as production of other fighter types in the U. S. is sufficient for replacements to be sent over.

Rearmament of Western Europe under MDAP is finally gaining momentum with announced shipments of jet fighters. To Britain's Royal Air Force will go 500 F-86 Sabres. About 300 F-84 Thunderjets will be shipped to European nations next year, with approximately 800 of this type expected to be in French and Italian hands by the end of 1951.

Deliveries of both aircraft spares and equipment under MDAP are being stepped up as rapidly as possible. By next September it is anticipated that the halfway mark will be reached in the $1-billion-plus program.

▶**Who Pays**—The U. S. contribution of aviation aid to MDAP nations totals $1,150,596,849 and stems from these sources:

- **Air Force**, responsible for the lion's share, has earmarked $1,113,442,117 from its fiscal 1951 appropriation.
- **Navy** is putting up $30,061,588 out of its fiscal 1951 funds.
- **Army** is committing $5,093,144 of its fiscal 1951 funds for purchase of liaison aircraft.

Deterrent to War

If war comes, high military circles believe it will come as a result of gradual involvement of the United Nations in several simultaneous engagements throughout the globe.

Oil, say these military experts, remains the common denominator of a nation's ability to wage war.

At present, according to best intelligence reports, Russia has little more than one-eighth of this nation's production capacity for petroleum. Yet, its military machine is estimated to be nearly five times as large as that of the United Nations.

▶**Danger Spots**—The U. N. still expects the real Russian blow to be directed towards the Near and Middle East, Iran, Turkey, Arabia, etc., wherein lie vast deposits of oil virtually unprotected.

To modify its apparent oil shortages, Russia with strange reasoning has dismantled all existing synthetic oil producing plants from its occupation zone of Germany and moved them to remote Ural Mountain retreats.

While these synthetic producers could supply for several years a part of the huge Russian air force, their very remoteness from the war-threat areas would prove an expensive tax on logistical supplies of fuel to a front.

This, then, accounts for our increasingly rapid build-up of air bases in the Near and Middle Eastern nations; and of programmed heavy contributions of piston-engined shipboard fighters to the navies of NATO nations through MDAP.

▶**Production the Safeguard**—Our tremendous industrial potential looms large as the main reason why Russia has not yet risked war. During World War II, the U. S., with only 6 percent of the world's population and 7 percent of its land area, produced more than 40 percent of the world's weapons.

Even more startling is the fact that at no time during World War II did our war effort absorb more than two-fifths of our total national output. We produced all of the equipment and supplies that our own troops needed; we supplied vast quantities of munitions to our allies, and, at the same time, we provided our own civilian economy with a greater total amount of goods and services than in such prewar years as 1937 and 1939.

Strategic Air Force

It remains apparent that arrival of all-out war must inevitably be signalled by determined enemy attack upon this nation's industrial potential.

As a result, the Joint Chiefs of Staff have held that, until guided missiles capable of intercontinental ranges are developed, primacy of strategic air force cannot be questioned in USAF's assigned role and missions.

Composition of the strategic air arm is dictated by the plans of the Joint Chiefs of Staff. The Strategic Air Command under direct JCS control, can be ordered to any point in the world at the first sign of hostilities. Thus the emphasis the Air Force gives to providing the JCS with a real weapon in being.

▶**SAC's Sock**—If war came "tomorrow", backbone of the USAF long-range striking force would still be the modified bomber of World War II—not the B-36. Most of the planes currently comprising the SAC sock are improved B-29 and B-50 bombers relying on aerial refueling for extreme-range missions.

Strategic Air Command at the time of Korea was comprised of 19 groups. Of this number, 14 were heavy bomb groups, three strategic reconnaissance. Three of the 14 groups are equipped, although not completely, with the B-36. A fourth group began conversion in August. The remaining 10 are divided between four B-50 groups and six B-29 groups. Group strength of 10 groups is being augmented by KB-29 KB-50 and KC-97 aerial tankers.

CONVAIR B-36D: Strategic Air Command has the quality, but not the quantity.

Currently, all three reconnaissance wings are using World War II B-29s. Conversion to RB-36 planes is under way for two groups and the third will get RB-47s. Plans call for reconnaissance and bomber type aircraft in each group on a 1-6 ratio. For reconnaissance bombers of the B-36 type only the ratio will be 1-2.

► **New Bombers**—With planned phase-out of the present B-36 program scheduled by Jan. 1, 1955, USAF is preparing to test newer aircraft which can fly even faster, higher, and farther than the present strategic bomber B-36.

The Senior Officers Board, after long deliberation, is requesting Consolidated Vultee Aircraft Corp. to build an experimental sweptwing, turboprop-powered version of its present B-36. Boeing Airplane Co., meanwhile, is building two experimental XB-52 bombers and expects to have one ready for flight test possibly late this winter.

Current thinking is that the slightly smaller B-52 will have a decided edge over the B-36. If, however, the B-52 is selected it will go into major production at Convair-Ft. Worth, although some models of the B-52 will come off Boeing-Seattle lines. Air Force holds adamantly that major military airframe programs will come in phase at inland plants.

► **Fighter Problems**—Biggest problem facing SAC planning is necessity of sending the strategic bomber on long-range missions unescorted. Heartland of the aggressor can be reached only after long arduous flight over large areas of enemy held land masses.

Problem of providing long-range fighter escort thus far has not been solved.

Fact remains, then, that for the next several years—probably throughout the lifetime of the strategic bomber concept—there will be no fighters with range capabilities of the present B-36 or its successor.

Thus, defense of the bomber is limited by its ability to fly high and fast and to force enemy interception to sonic speeds and to use of still unproven air-to-air-rockets for defense firepower, replacing the 20mm. cannon used by most planes today.

Tactical Dispute

Dissatisfaction by the Army with USAF current technique of tactical support has reached the boiling point. Air Force claims that planes assigned to close ground support must be able to live in the air against enemy attackers first, and that their tactical air-ground capabilities are second.

► **The Argument**—The Army claims this reasoning is fallacious. It contends that design for the tactical support plane should first be able to conform with the Army requirement and secondly to the Air Force requirement—ability to live in the air.

So far, procurement of aircraft for Army use remains a point of Army dissatisfaction. Virtually all aircraft owned by the Army are obtained for it by the Air Force. Army is restricted to purchase of aircraft weighing less than 2500 lb., and to helicopters weighing less than 4000 lb. But sometime in calendar year 1951 will see removal of these weight restrictions. Army will then be able to move more decisively into development of aircraft to meet its requirements.

Army will probably win authorization this year to establish its own logistical air support service. From the Army point of view, organic troop carrier and transport units would be expedient. Training of the airborne forces and other units could be closely monitored.

Further, Army would be able to use its own transport, at will, for its own transport needs much in the same manner as it uses its trucks. It claims need for its own air transport service much in the same manner that Air Force needs trucks, buses, tractors, and other ground mechanized equipment to provide maintenance for its airlift mission.

Navy Finds Its Place

Assignment to the Navy by the Defense Department during the Forrestal Key West conference of the prime role of anti-submarine warfare is now being followed with enthusiasm. Navy has found that proper conduct of that role requires an air and sea force of even greater proportions than it envisioned during its early battles for joint control of the "strategic" mission held by Air Force.

Two years ago, Navy deplored the Air Force role of strategic air power via its "big stick"—the B-36. It contended that super aircraft carriers capable of approaching enemy land masses, and then discharging long-range airborne weapon carriers was the best solution to intercontinental strategic warfare. It proposed construction of a 65,000-ton flush deck aircraft carrier which would be the first of the strategic floating air bases. This program was scuttled in the Louis Johnson defense regime at the Pentagon.

Undeterred, Navy continued pressing for that type of aircraft carrier and mission. Finally, late last year it succeeded in obtaining funds for a 56,000-ton semi-flush deck carrier to exploit its "anti-submarine role." Aircraft which will be used aboard the super-carrier will be very long-range fighter-bombers and patrol bombers.

Naval aviation trend, generally, continues towards heavier aircraft, featuring long-range, high altitude characteristics. All of its present operational carriers are being modified to withstand heavier deck loads.

Weapons of the Future

Appointment of K. T. Keller to head up the Department of Defense Office of Guided Missiles has signaled the emergence of the department from a program of research and development to immediate procurement.

► **Missiles Coming**—Several guided missiles for each of the military services will be in production this year. A quantity of production missiles will reach the services for simulated combat testing this fall and winter. Tactical use of a few interim guided missiles is envisioned by spring of 1952.

Most of these, with the exception of air-to-air missiles, will have speeds in the high subsonic ranges. Supersonic missiles, particularly those with intercontinental range, are not yet sufficiently developed for service testing and will not be available before 1956. A few air-to-air missiles are in final stages of test, and quantity production is ordered from fiscal 1951 and 52 funds.

Completely automatic electronic control of fighter aircraft is very near. Hughes Aircraft Co. has under development an electronic control for fighter planes which will virtually eliminate manual control by the human pilot.

The pilot, of course, will remain an essential factor in the plane's total utilization. He will, however, be relegated to an eventual role as monitor of the fighter.

Group Strength Classification

USAF operated within a 48-group structure at beginning of Korean hostilities. Authorized build-up shortly thereafter permitted an increase to 69 groups and subsequently to a 95-group structure. Industrial expansion as a result of the current international situation aims towards 185 groups.

At the time the U.N. forces moved into Korea, Air Force actually operated 52 groups and 13 separate supporting squadrons. Its civilian components, the Air Force Reserve and the Air National Guard, were organized into 27 groups and 25 base wings respectively.

Air Force has already ordered into active duty 10 ANG Groups and 4 USAFR Wings. It has announced that an additional 12 ANG Groups and 21 USAFR wings will be drawn into regular establishment during the next three months. Additionally, Air Force has activated several new groups, and will therefore, by next June 30, be operating in excess of 100 groups.

As of June 30, 1950, USAF counted 8700 aircraft on its active list. This comprised 3200 combat types (bombers, tankers, fighters, search and rescue, etc.) and 5500 utility types (transports, trainers, liaison, and former combat types used for utility need).

The Air National Guard operated 2700 aircraft, both utility and combat types, while the Air Force Reserve operated 900 more.

8200 aircraft were listed under inactive status (storage, in pipeline, and on bailment to civilian contractors for modification.)

Strength of squadrons and groups comprising these components are based upon a group's mission and type of craft employed therein. Today, group strength classifications are:

TYPE OF AIRCRAFT	NUMBER OF PLANES PER SQUADRON	GROUP
Heavy bomber (B-36)	10	30
Medium bomber (B-50, B-47, B-29) (some medium bomber groups are comprised of 45 planes to a group and 20 tankers)	10	30
Light bomber (B-26, Canberra B.2, B-51)	16	48
Troop carrier, Heavy (C-54, C-74, C-124)	12	36
Troop carrier, Light (C-82, C-47, C-119, XC-123)	16	48
Fighter (F-86, F-80, F-84, F-51)	25	75
All-Weather Fighter (F-82, F-89, F-94)	12	36
Tactical recon. (RF-80, RB-26, RB-45, RB-51)	18	54
Strategic recon. (B-29, B-50, B-36) (B-36 reconnaissance groups have 30 planes)	12	36
Liaison (L-5, L-19, L-13, H-5)	16	0
Tow target (B-26, B-45)	9	0
Rescue (SA-16, SB-29, C-82, SB-17, H-21)	36	0

USAF Spurs Expanded Production

Biggest aim now is to have at least two suppliers for every major aircraft to minimize effects of attack.

In its fourth year of autonomy, the United States Air Force holds the dominant position in the nation's Armed Forces.

It tops its sister services once again in 1951 regular and supplemental budgets by an impressive margin. A total of $13.9 billion already has been programmed for USAF in fiscal year 1951.

A high Pentagon source has indicated to AVIATION WEEK that nearly $5 billion additional procurement funds are being scheduled in still another 1951 supplemental appropriation.

A total of $9.25 billion is provided already for Air Force hardware in 1951 fiscal year. Hard goods program is expected to exceed $12 billion for the presently-planned supplemental and the regular 1952 budget.

▶ **Time to Prepare**—Main objective of the 2nd Supplemental budget, requested of Congress a short time ago, was to broaden the industrial base for weapons production. And $410 million was set aside for this purpose.

Broadening the base for production of aircraft is of critical importance to achieve the rate of production necessary at the outset of a future war. Complex modern war technology has placed the highest premium on swift and efficient industrial mobilization. Studies indicate that full mobilization of the aircraft industry cannot be achieved until 16 to 18 months after a national emergency declaration.

To widen USAF's industrial base as rapidly as possible, Under-secretary of Air Force John A. McCone has ordered contracts with at least two geographically separate suppliers for virtually every major aircraft.

• **In the heavy bomber category,** the B-36 is now in production only at Consolidated Vultee's Fort Worth plant, as is the heavy reconnaissance bomber, RB-36. Production under USAF expansion has been doubled. The company has recently completed survey of a large New Orleans facility in case still heavier production is ordered.

• **In the medium bomber field,** the B-47 is in accelerated production at Boeing Wichita, is starting at the Douglas plant at Tulsa, and will soon go into production at the Lockheed Marietta, Georgia, plant. The Boeing B-50, now phasing-out gradually as B-47 production is stepped up, is in production at Boeing-Seattle. The only new reconnaissance bomber planned for production is still mainly on paper, the RB-47 at Boeing-Wichita. A four-engine RB-47C is to be rolled out later this year, following delivery of a new Allison jet engine.

• **In the fighter-bomber field,** the F-84E is in production at Republic's Farmingdale, N. Y. plant. The later sweptwing F-84F, equipped with the British-developed Sapphire jet engine, is now in test. This plane will be standardized this year for production at the Republic plant and will also be put into major production by General Motors at Kansas City, Kans.

The North American F-86, a firstline fighter-bomber, is now in major production at Inglewood, Calif. North American will also produce the F-86 and its Navy counterpart, the FJ-2 at Columbus, Ohio.

• **In the interceptor category,** a new version of the F-86 designed for interceptor operation is in flight test at Muroc and will go into production shortly at Columbus, as well as at Inglewood.

The Northrop F-89, of which more than 500 are now on order, is in production thus far only at Northrop's Hawthorne, Calif., plant. Accelerated production is, however, contemplated at a mid west city (probably Omaha) in the near future. The Lockheed F-94, currently rated as an all-weather fighter intruder, is in production only at Lockheed's Burbank, Calif., plant.

Republics RF-84 is the only plane presently delegated to tactical reconnaissance operation.

• **In the heavy transport category,** pro-

duction of the C-97 and tanker KC-97 is maintained at Boeing's Renton and Seattle, Wash., plants.

Cargo version of Douglas C-118B is underway at the company's Long Beach, Calif., plant, as is the cargo version of the C-121B at Lockheed's Burbank plant.

A heavy strategic transport, the Douglas C-124, is under accelerated production at Douglas' Long Beach, plant.

• **In the medium transport field**, the C-119B to be replaced in a few months by the C-119C and phased into production in Fairchild's Hagerstown, Md., plant. Kaiser-Frazer is scheduled to begin C-119C production at Willow Run, Mich., early next year.

Major production of Chase Aircraft's C-123 assault transport will get underway at Birmingham, Ala., and Trenton, N. J., immediately. Peak production is scheduled for June, 1952.

• **In the trainer field**, the North American T-28 is under heavily accelerated production at the plant. The multiplace navigational trainer T-29 is being stepped up at Convair's San Diego plant. Considerable numbers of advanced single-engine trainers, the T-33, are in accelerated production at Lockheed's Burbank plant.

• **For search and rescue**, the Air Force has increased its orders for the SA-16, which is manufactured by Grumman at Bethpage, Long Island. Helicopters, finally coming into their own for multipurpose use but still officially designated to search and rescue, are also being tooled for accelerated production. The three currently on order by Air Force are the YH-12 at Bell's Buffalo plant, the H-19 at the Sikorsky Bridgeport, Conn., plant, and the H-21 at the Piasecki Morton, Pa., plant.

► **Powerplant Production**—Engine manufacture has likewise been crystalized and suppliers both in the immediate aircraft engine plants and by the mass producing automobile plants have been notified of production timetables.

Pratt & Whitney at East Hartford, Conn., will produce the R-1340, R-1830, R-4360, R-2800 and the J-48. Ford Motor Co. will produce the R-4360 at Chicago and the J-48 at Dearborn. General Electric will produce the J-47 at its Lockland, Ohio, and Lynn, Mass., plants, as will Packard at Detroit, Mich., and Studebaker at South Bend, Ind. Allison will produce the J-35 and J-33 at Indianapolis. Chevrolet division of General Motors will build more Allison J-35s at Tonawanda, N. Y. Wright concentrates on production of the Sapphire (J-65) and the R-3350 at Wood-Ridge, N. J. Buick division of General Motors will also build the J-65 at Flint, Mich. Lycoming division, Avco Corp., will build the R-1820 at Stratford, Conn., while Nash motors will build the R-2800 at Kenosha, Wisc., and Kaiser-Frazer will build the R-1300 at Detroit.

Curtiss-Wright Corp. and Aeroproducts division of General Motors divide the bulk of Air Force propeller business.

► **Avionics**—The large-scale expenditure going for electronic, electric, and communications equipment, is shared principally by Sperry Corp., Lear, Inc., Minneapolis-Honeywell, Bendix Aviation, Hughes Aircraft, R.C.A., Philco, Western Electric, General Electric, Emerson Electric, General Mills, Collins Radio, Raytheon, Radioplane, and A. O. Smith Corp.

By integrating automobile manufacturers and other civilian plants into the aircraft production program, USAF is getting enough facilities so that by June, 1952, it will be ready for an almost overnight expansion of aircraft production to a rate that will supply an 185-group Air Force.

► **Expansion Plans**—Aircraft procurement for the Air Force will be further increased over the 4428 planes already announced as programmed for the year. About $1 billion of USAF funds appropriated for procurement, however, is to offset price rises. The rest is expected to buy about 1000 aircraft.

The Air Force today has about 60 groups in operational status, and has been authorized an expanded structure of 95 groups. Manpower-wise, it is achieving this expansion as rapidly as planes are provided by calling up additional Air National Guard and Air Reserve wings, and expanding training to make up the full 95-group strength.

Research and Development funds appropriated for fiscal 1951 are nearly doubled. So far this year $356 million have been made available for this purpose. An almost equal amount is scheduled in the 3rd Supplemental which will be presented to Congress shortly. In the last fiscal year $210 million was appropriated.

Part of the 3rd Supplemental funds will be used for completion of construction of the long-range guided missiles proving ground at Banana River, Fla. Its total estimated cost is $75 million. Last year, Air Force spent $5 million on the installation and has received only $6 million for its continued construction this year.

► **Tactical Support**—Despite much outside pressure on the problems of tactical air support in Korea, the Air Force position on this subject has not changed materially although heavily-increased funds have been made available for tactical air support needs.

However, in the over-all build-up of the Air Force structure, the long-delayed purchase of Chase Aircraft's XC-123, undisputed winner of an Air Force evaluation for assault transports, is finally near completion. Chase Aircraft shortly will have a contract for more than 300 C-123 medium transports.

► **Interceptors**—To date, although several planes are designated interceptors, Air Force has no interceptors capable of meeting requirements. To meet this deficiency, electronics and airframe manufacturers were called to Washington. Air Force presented the problem of what it needed to meet the threat of future enemy weapons in a two-phase packaged program. Hughes Aircraft won Phase I—design of the electronic control. It is now at work on the problem. Phase II—airframe design—is now completed by the manufacturers and is in the hands of the Air Force for decision on competition. Expectations are that a completely automatic piloted interceptor capable of sonic speed, will be operational by Jan. 1, 1955.

► **Helicopters**—Research and development programs of all three services put heavy emphasis on the helicopter. The Piasecki H-21 is even now undergoing an accelerated production to meet needs of the Army and Air Force. The C-54-sized Piasecki XH-16 is developing on schedule and will make its first flight in mid-1952. Substantial progress has been made on single-components manufacture of the huge helicopter transport. Prime difficulty, design of an automatic pilot and instrumentation for blind flight, has been licked.

The heavy-duty XH-17 (flying crane) helicopter, under development by Hughes Aircraft, is being accelerated. Ground test of the XH-17 is already in an advanced stage with flight scheduled in 1953. Companion developments of large rotor blades and ramjet power systems are still bogged down by high fuel consumption and noise level, although substantial progress in elimination of that difficulty has been made in the past year.

AF Operating Costs

Direct cost per flying hour for Air Force planes for supplies, equipment, gas, oil, and lubes (exclusive of labor costs) is:

Type of Aircraft:	
B-26	75.25
B-29	233.32
B-36	1,024.17
B-45	386.77
B-50	421.00
C-46	57.50
C-117	37.66
C-74	237.45
C-82	79.27
C-97	272.40
F-80	120.18
F-84	117.00
F-86	145.11
H-5	40.54
T-6	13.84

Navy Air Strength Shows Increase

End of strict restrictions on its spending finds navy in fine shape, mapping future expansion schedules.

Forced for the last three years to strict economy, and therefore to a program of building quality instead of quantity into its air arm, the Navy has emerged from its "depression days" in fine shape. While its overall procurement is less than half that programmed for Air Force dollar-wise, it has shown a remarkable increase in strength.

As of Dec. 30, 1950, Naval aircraft strength consisted of some 6200 fleet combat, combat support and shore establishment craft; approximately 3150 USNR craft, and approximately 3200 aircraft non-operational and in storage.

Navy's 1951 procurement, including basic 1st and 2nd Supplemental appropriations, totaled $2,534,769,000. By mid-January it had committed $1.8 billion of a total $3 billion appropriated, and had obligated $1,330,424,000.

Top Navy officials predict that forthcoming 3rd Supplemental appropriations proposals will have to include an additional $1.7 billion if presently planned Naval aircraft expansion schedules are to be met. Present programming further indicates a budgetary requirement of more than $5 billion for aircraft and facilities in 1952 to meet expansion of the Naval air establishment.

▶ **Nine Contractors**—Nine aircraft manufacturers are prime contractors in the revised 1951 program.

• **Grumman aircraft** has an extensive contract for F9F and service test quantities of F10F fighters. It also has substantial contracts for AF-2s and AF-2W anti-submarine aircraft.

• **McDonnell Aircraft** will build a substantial number of F2H fighters.

• **Douglas Aircraft** will supply Navy with F3D jet fighters, the AD-4, AD-4N, AD-4W and A2D attack planes, as well as R6D and R4D-1 transports.

• **Lockheed Aircraft** will supply greatly increased numbers of P2V-5 and P2V-6 patrol planes, and a lesser number of PO-2W radar warning planes, TO-2 jet fighter trainers and a small number of R7O-1 transports.

• **North American** will build a sizeable quantity of AJ-1 attack bombers for Navy and a considerable quantity of FJ-2 (Air Force F-86) jet fighters.

• **Glenn L. Martin Co.** will build a quantity of P5M-1 flying boats and a similar quantity of P4M-1 patrol planes.

• **Consolidated-Vultee** will begin major production of the R3Y-1 flying boat, probably this fall at San Diego, following completion of flight tests this spring.

• **Chance Vought div.** of United Aircraft will build a considerable number of F7U-3 fighters at Dallas.

• **Fairchild** received an order for a small quantity of R4Q (USAF C-119) transports.

▶ **Copter Contracts**—Five helicopter companies share Navy contracts almost on an equal basis. Manufacturers include Sikorsky, Piasecki and Bell as the major contractors. Helicopters on order include the Sikorsky HO4S and HO5S, Piasecki HUP, Bell HTL and HSL, Hiller HTE, and the Kaman HOK.

Principal engine companies supplying powerplants for Navy are Pratt & Whitney, with the R-2800 and R-4360 piston engine, the J-42 and J-48 jet engines and the T-34 turboprop. Allison division of General Motors will supply J-33 jet engines and the T-40 turboprop. Westinghouse will supply the J-34 and the J-40, General Electric the J-47, Curtiss-Wright the R-3350 piston engine and the Sapphire J-65 jet engine.

Hamilton Standard div., United Aircraft Corp., is the largest Navy propeller contractor, with Aeroproducts and Curtiss-Wright sharing the remaining propeller business.

▶ **Aircraft Carriers**—Virtually all Navy's aircraft carriers are scheduled for modifications to strengthen flight decks, increase capacity of catapults, and provide greater gasoline-handling capacities. Modification of carriers in operational status is already nearly complete. Withdrawal from mothballs of additional carriers is scheduled through 1951 and 1952, to meet the needs of expanded Atlantic and Pacific Fleets.

▶ **Aircraft in Storage**—Naval aircraft in storage, for the most part in far better condition than stored Air Force planes, are being withdrawn rapidly to meet the needs of expanded Naval and Marine operations. But most of these are being replaced as rapidly as possible by new heavier aircraft, both jet and piston-engined. Substantial quantities of stored aircraft are being modernized and shipped to the North Atlantic Treaty Organization group under Mutual Defense Assistance Program to round out their depleted carrier stocks.

While sizeable numbers of training planes are still in storage, attrition rates as a result of Korea and an expanded training program are rapidly depleting stores. No immediate procurement of training planes is envisaged during calendar 1951, but procurement of new trainer types will begin in the last half of fiscal 1952.

Navy has moved to a complete revision of strategy and a regrouping of fleet units to meet its new anti-submarine warfare assignments.

▶ **Guided Missiles**—Guided missile ships are joining the fleet in increasing numbers through modification of existing surface craft. Navy research and development places great emphasis on the guided missile as a means of effectively combating the threat of Russian submarine fleets. Extensive progress in surface-to-subsurface and air-to-subsurface guided missiles has already been made. Two types of surface-to-subsurface and three air-to-subsurface are programmed for service test production during fiscal 1952.

Ship-to-shore guided missile research and development has forged ahead remarkably and a new missile of this category will be in service test during calendar year 1951.

FIGHTERS AND SUB-KILLERS, such as Chance Vought F7U (left) and Lockheed P2V are the core of Navy's new air power.

The Army's Role in Air Power

Ground arm insisting on new types of transports and freedom to buy own planes; USAF gradually yielding.

Increased emphasis on air transportability for ground troops, resulting from lessons learned in World War II, has forced Army to greater reliance upon airlift.

When Air Force gained autonomy in 1947, Army had presumed that a much closer relationship would be maintained with its offspring.

Subsequent events have led high-ranking Army officers to believe that such is definitely not the case. They have been vociferous in condemnation of the low priority Air Force has assigned to tactical air support problems. While this is denied officially, because of party-line decisions to solve the problem internally, Army, until this last week, found Air Force virtually ignoring its stated needs.

▶ **XC-123 Delay**—Air Force staff agencies now have begun paper work to order the long-delayed production of Chase Aircraft Co.'s XC-123 assault transport. Air Force has finally ordered well over 300 planes in an initial production program. But this came only after Army had reached a point in the XC-123 controversy where staff papers were being prepared to investigate Air Force failure to purchase the plane in quantity.

The plane is the only aircraft in existence in this country built specifically to meet Army assault transport requirements.

Army is still beset by inadequacies of USAF transport aircraft in meeting Army logistical supply needs. For example, Exercise Swarmer conducted last summer in the Carolinas, showed conclusively that Air Force transport craft, by and large, are inefficient in their loading and unloading characteristics.

▶ **Let the User Beware**—Army is also battling Air Force insistence that Army planes should be made to conform to Air Force-sponsored airframe designs. Army planners contend that the air platforms should be designed to meet the needs of the user instead of forcing the user to meet the design requirement of present airlift.

Today, much to Army's dismay, Air Force has embarked upon a procurement program emphasizing very large, very heavy, strategic transports. Air Force planners are apparently convinced, say Army critics, that it must perform solely long-range strategic airlift of mass equipment.

But the facts are that, except in unusual cases, the bulk of Army equipment will be a problem for land and sea logistical movement for years to come. Army cites the case of Korea. A major part of this nation's airlift potential was not only unneeded, but it was unable to get near battle areas of Korea, it is pointed out.

Army planners do not in any sense decry the strategic airlift potential of Military Air Transport Service. But they do feel that the equipment is not designed for adequately fulfilling its prime mission. Loading access to virtually all MATS aircraft is possible only at major air base facilities. The Douglas C-124, one of the largest transports today can fly into Fort Knox, they point out, but presently cannot get out fully loaded. We must assume, Army planners claim, that most bases in a battle area would surely be of lesser quality than the Fort Knox installation.

Army wants more emphasis on the original design of medium transports capable of fulfilling a military transport requirement instead of adopting commercial transport types for military use. A change in design approach is even more important, they contend, in design of very heavy transport craft.

▶ **Liaison Needs**—Last year the Army, for the first time since the Air Force gained separate status, purchased through its Ordnance Department, a sizeable quantity of light aircraft. It will purchase an even greater number out of its fiscal '52 budget funds. It has been estimated that almost $150 million will be set aside for aircraft purchases.

Long harassed by an agreed restriction to the purchase of liaison aircraft weighing less than 2500 lb. and helicopters weighing less than 4000 lb., Army has received assurance that those weight limitations will be canceled completely. This will enable Army to foster development of aircraft and research modifications of existing types more adequately to meet the Army requirements for its tactical aircraft needs.

▶ **Copter Interest**—Army is particularly eager that the weight limitation on helicopter procurement be waived immediately. It is anxious to share development of the helicopter now fostered to a large extent by the Navy and Marine Corps. Army sees the helicopter as the aircraft most likely to fill its immediate requirements in liaison, wire laying, artillery spotting, light logistical supply and transport problems.

In 1946 it sponsored the continued development of helicopters when Navy and Air Force virtually ignored them. In 1948 it placed the largest single order for helicopters the industry had known. It was an order for 65 H-13Bs. In 1950 it ordered 86 H-13Ds and followed it a month later with an additional order for 50 H-23s. It has bought or has on order every CAA-approved two- or four-place helicopter built in this country.

In the multi-place utility rotary-wing category, Army utilizes the H-13D, the H-23 and the H-18. In the light cargo rotary-wing category, Army favors the H-12 and HUP. In the heavy, 6000-to-8000-lb. payload category, future Army planning is based on the Piasecki H-16, and in the very heavy short-range helicopter category, Army places great faith in the Hughes H-17 which is expected for service testing in 1953.

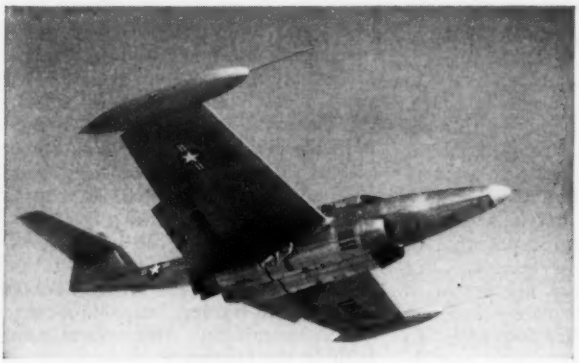
To equip its recently organized Transportation Corps helicopter companies Army may turn to the H-21, with a 4000-lb. payload capability, and the H-19 with a 2000-lb. payload capability. Army was greatly disappointed by Air Force cancellation of contracts early last year of the H-21 and H-19. These copters, however, are scheduled by Air Force for major production in 1951.

▶ **Convertaplane Concept**—Ultimate answer to Army's need in most aircraft fields would be the convertaplane, a vehicle not yet built, which can take off and land vertically, incorporating the hovering characteristics of the helicopter, yet combining the horizontal flight speeds of conventional fixed-wing aircraft. Air Force is mildly interested and Navy openly scoffs at the serious mechanical problems involved. Nevertheless a design competition for the construction of a convertaplane has just been completed and the winner is to be announced shortly.

Army expects an X model will be flying early in 1952 and hopes that 1953 will see the convertaplane in major production. While the convertaplant concept is felt in Air Force and Navy circles to be somewhat wishful, funds diverted for prototype development of the plane are said to be more than adequate to assure production by 1953.

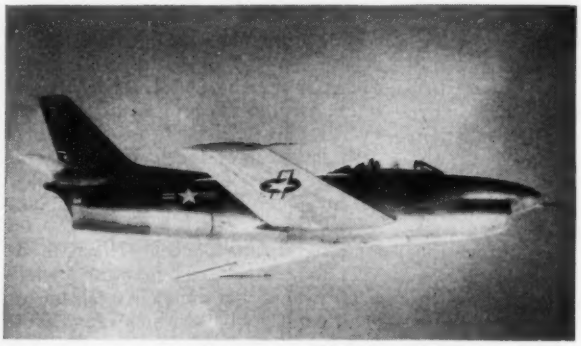
▶ **Tactical Control**—Heavy pressure has been brought to bear in all three services to place Army in complete control of tactical air support. Competent Army and Air Force leaders believe, however, that creation of an Army tactical support service would be a needless duplication of school systems, supply, instructional and maintenance facilities. Current thinking, is to correct existing command relations between services, instead. Tactical air forces in support of armies soon will be placed under Army command in combat maneuvers.

Among U. S. Military Planes . . .

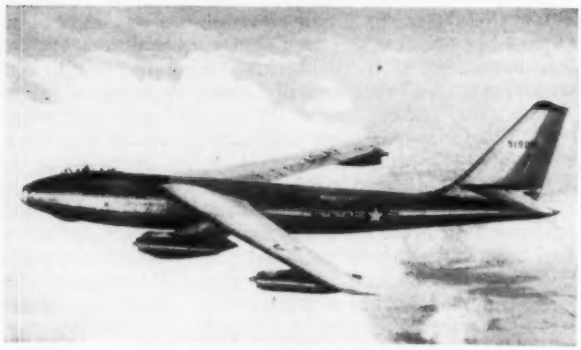


Northrop F-89 Scorpion

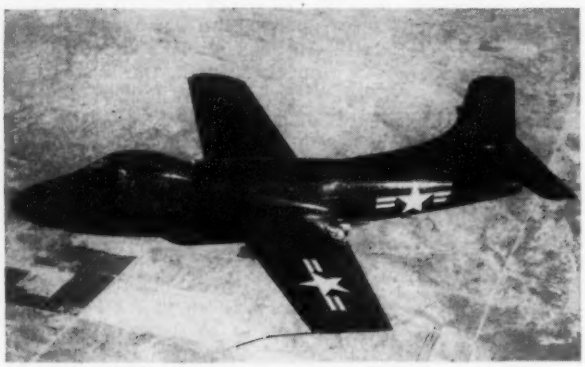
McDonnell F2H-1 Banshee



North American F-86D Sabre



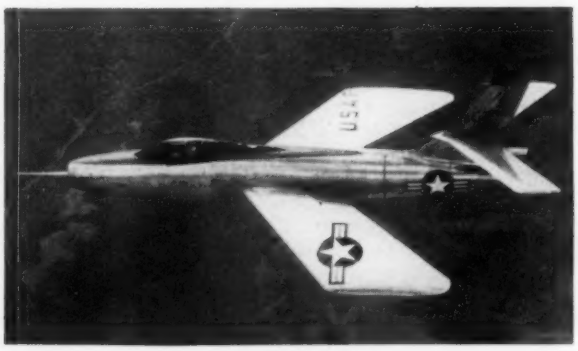
Boeing B-47A Stratojet



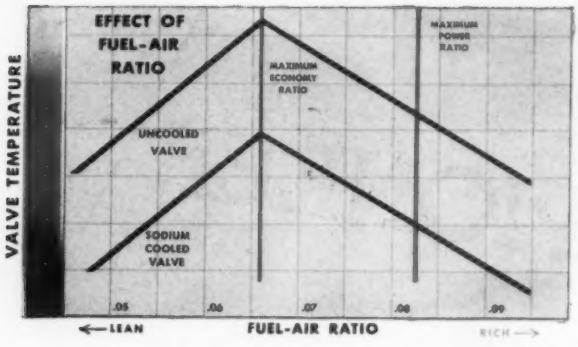
Douglas XF3D-1 Skyknight

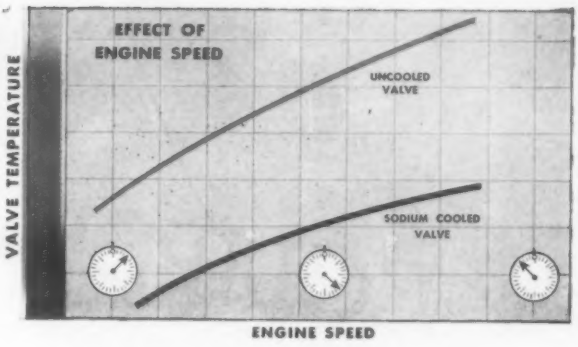
Douglas XA2D-1 Skyshark

Grumman F9F-5 Panther

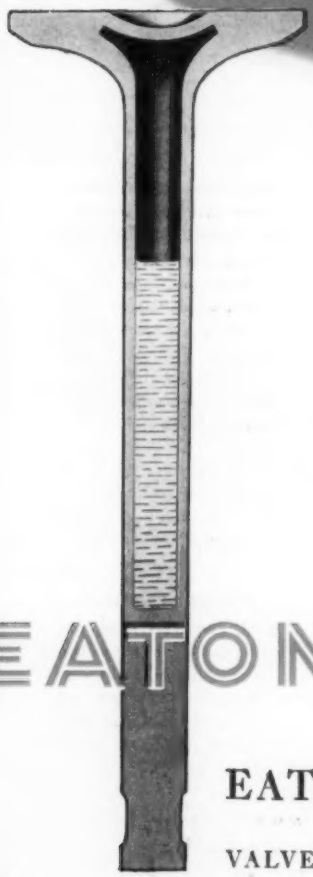


Republic XF-91





The Effectiveness of Sodium Cooling



In considering factors which influence exhaust valve life, temperature is the dominant one. High temperatures sharply reduce the resistance to corrosion, distortion, and fatigue life of the finest alloy steel. The effectiveness of sodium cooling in reducing valve temperatures is shown by the curves above, typical of recorded test data.

The curve "Effect of Fuel-Air Ratio" shows that as the mixture is leaned out to obtain maximum economy, valve temperatures rise. The curve showing "Effect of Engine Speed" indicates that temperature rises rapidly as speed increases.

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Among U. S. Military Planes . . .

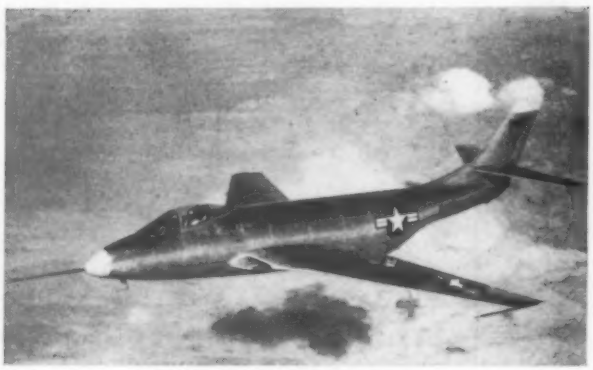
North American AJ-1

Consolidated Vultee R3Y-1

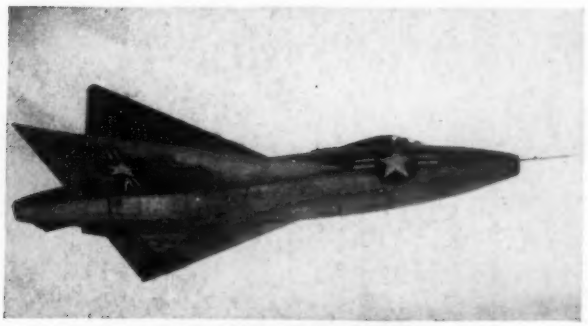
North American T-28

Grumman AF-2W Guardian

Republic F-84E Thunderjet



McDonnell XF-88 Voodoo



Consolidated Vultee XF-92A

Martin XB-51

U. S. Military Aircraft

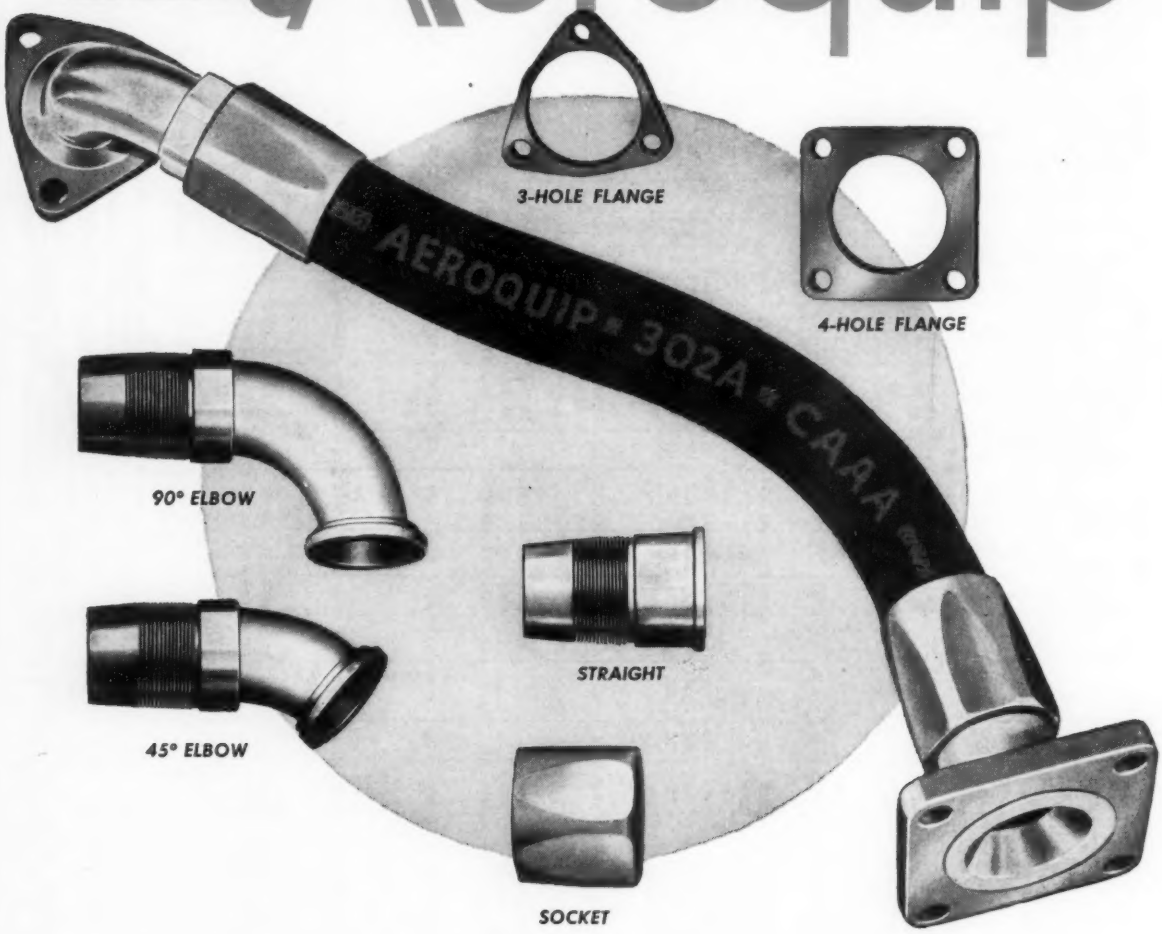
Manufacturer and Address	Designation: Model	Designation: Name	Type	Number of crew	Powerplant: Number and make of engine	Powerplant: Maximum hp. or lb. thrust ea.	Powerplant: Normal rated hp. or lb. thrust	Powerplant: Normal fuel capacity (gal.)	Performance: Normal range (mi.)	Performance: Maximum speed (mph.)	Performance: At altitude (ft.)	Performance: Service ceiling (ft.)	Performance: Takeoff run, no wind (ft.) over 50ft. obstacle	Weights: Gross weight (lb.)	Weights: Empty weight (lb.)	Weights: Wing loading (lb./sq. ft.)	Weights: Power loading (lb./hp. or lb. thrust)	Dimensions: Span	Dimensions: Length	Dimensions: Height	Dimensions: Wing area (sq. ft.)	Remarks
Beech Aircraft Corp. Wichita, Kan.	YT-34	Mentor	Trainer	2	1 Con E-225-8	225	210	50	770	188	SL	21,200	918	2750	2055	15.5	13.1	32′ 10″	25′ 10″	9′ 7″	177.6	Bonanza development.
Boeing Airplane Co. Seattle 14, Wash.	B-47A	Stratojet	Med. Bomb.	3	6 GE J47	.....	5200*	.....	2000+	600+	.....	35,000+	.....	185,000	.....	.....	.....	116′	108′	28′	.....	Bomb load over 10 tons.
	B-50D	Superfortress	Med. Bomb.	11	4 P&W R-4360-35	3500	.....	.....	6000	400+	.....	40,000+	.....	164,500	.....	.....	.....	141′ 3″	99′	32′ 9″	.....	B-29 development.
Cessna Aircraft Co. Wichita, Kan.	L-19A	.....	Liaison	2	1 Con E-407-11	213	190	42	306	.....	.....	22,900	560	2100	1448	12.1	11.05	36′	25′	7′ 6″	.....	Used by Army Field Forces.
Consolidated Vultee Aircraft Corp. San Diego 12, Calif.	B-36D	.....	Heavy Bomb.	15	6 P&W R-4360-41[1]	3500	.....	21,000+	10,000	435+	.....	45,000+	.....	358,000*	.....	.....	.....	230′	162′	46′ 9″	4772	B-36F has 3800-hp. Wasp Majors.
	XF-92A	.....	Research	1	1 All J33-A-29	.....	.....	.....	.....	.....	.....	.....	.....	15,000	.....	.....	.....	31′	44′	15′	425	Delta wing interceptor research.
	T-29	.....	Trainer	...	2 P&W R-2800 CA18	2400	1800	1000	.....	316	13,500	26,100	2720	40,011	28,973	49	8.35	91′ 9″	74′ 8″	26′ 11″	817	Convair-Liner as USAF crew trainer.
	XP5Y-1(R3Y-1)	.....	Patrol-Trans.	12	4 All XT40-A-4a, b	5500	.....	.....	*3500+*	*390+*	.....	.....	30sec.	120,000+	.....	.....	.....	146′	130′	.....	.....	Six blade 180-in. Aeroproducts props.
Douglas Aircraft Co., Inc. 827 Lapham St. El Segundo, Calif.	AD-2	Skyraider	Attack	1-3	1 Wr R-3350-26W	2500	2100	.....	.....	350+	.....	.....	.....	16,065	10,519	40	6	50′	38′ 10″	15′ 7.5″	400	Standard carrier-based attack plane.
	XA2D-1	Skyshark	Attack	1	1 All XT40-A-2	5500	.....	800*[2]	.....	.....	.....	.....	.....	17,000*	.....	.....	.....	50′	.....	.....	400	Will also use P&W T34 turboprop.
	XF3D-1	Skyknight	AW Fighter.	2	*2 West J34-WE-38*	*3600*	.....	.....	1500*	600+	.....	*45,000+*	.....	27,000	.....	.....	.....	50′	45′	.....	.....	Has crew escape chute.
Fletcher Aviation Corp. 190 W. Colorado St. Pasadena, Calif.	FL-23	.....	Liaison	2	1 Con E-225	225	225	60	500	133	SL	20,000	565	2450	1550	8.7	10.9	33′ 4″	28′	9′	277	Hartzell 84″ prop.
Grumman Aircraft Eng'rg. Corp. Bethpage, Long Island, N. Y.	SA-16A(UF-1)	Albatross	Rescue	4-6	2 Wr R-1820-76A	1425	1275	675[3]	2706	247	SL	.....	900	27,025	20,100	32.4	10.6	80′	60′ 8″	24′ 3″	833	Fuel cells in tip floats.
	AF-2S, 2W	Guardian	ASW	1-2	1 P&W R-2800-46	2400	.....	.....	.....	350*	SL	.....	.....	25,000+	.....	.....	.....	60′ 8″	.....	.....	.....	Sub hunter-killer team.
	F9F-2	Panther	Fighter	1	1 P&W J42-P-6	5000	.....	.....	1200+	600+	SL	.....	.....	17,000*	.....	.....	.....	38′	40′	15′ 6″	.....	F9F-3 has All J33-A-8 at 4600-lb.
	F9F-5	Panther	Fighter	1	1 P&W J48-P-4	6250	.....	.....	.....	*650**	*SL*	.....	.....	18,000*	.....	.....	.....	38′	42′	16′	.....	F9F-2 development; new wings, tail.
	XF10F-1	.....	*Fighter*	*1*	*1 West J40*	*10,000**	*7500*	.....	.....	*800*	*SL*	.....	.....	*31,000**	.....	.....	.....	.....	.....	.....	.....	*Swept-wing carrier fighter*
Lockheed Aircraft Corp. Burbank, Calif.	F-80 (TO-1)	Shooting Star	Fighter	1	1 All J33-A-23	5200+	3900	755	1470	600+	SL	45,000+	2750	15,336	8240	64.6	3.5	38′ 10.5″	34′ 6″	11′ 4″	237.6	1727 delivered.
	XF-90	.....	Fighter	1	2 West J34[4]	3000*	.....	.....	.....	*700**	*SL*	*40,000*	.....	.....	.....	.....	.....	40′	55′	15′	342*	Adjustable swept tail.
	F-94A	.....	AW Fighter.	2	1 All J33-A-33	5200+[5]	3900	.....	.....	600+	SL	45,000+	.....	15,330	9557	64.5	3.3	38′ 10.5″	40′ 1.5″	12′ 5″	237.6	T-33 development.
	F-94C	.....	AW Fighter.	2	1 P&W J48	6250+[5]	.....	.....	.....	600+	SL	45,000+	.....	27,700	.....	.....	.....	.....	.....	.....	.....	
	T-33 (TO-2)		Trainer	2	1 All J33-A-23	5200+	3900	683	1345	600+	SL	45,000+	2750	14,442	8084	60.7	3.3	38′ 10.5″	37′ 8.5″	11′ 8″	237.6	F-80 development.
	P2V-4	Neptune	Patrol	4-9	2 Wr R-3350-30W	3250	2650	4210	4200	352	9500	26,100	4050	72,000	39,900	72	5.54	100′	77′ 11″	28′ 1″	1000	Has compound engines.

Manufacturer and Address	Designation: Model	Designation: Name	Type	Number of crew	Powerplant: Number and make of engine	Powerplant: Maximum hp. or lb. thrust ea.	Powerplant: Normal rated hp. or lb. thrust	Powerplant: Normal fuel capacity (gal.)	Performance: Normal range (mi.)	Performance: Maximum speed (mph.)	Performance: At altitude (ft.)	Performance: Service ceiling (ft.)	Performance: Takeoff run, no wind (ft.) over 50ft. obstacle	Weights: Gross weight (lb.)	Weights: Empty weight (lb.)	Weights: Wing loading (lb./sq. ft.)	Weights: Power loading (lb./hp. or lb. thrust)	Dimensions: Span	Dimensions: Length	Dimensions: Height	Dimensions: Wing area (sq. ft.)	Remarks
Glenn L. Martin Co. Baltimore 3, Md.	XB-51	.....	Att. Bomb.	2	*3 GE J47-GE-9*	.....	*5200* +	*4000*	.....	*585*	*25,000*	*45,000*	.....	*45,000**	*22,000*	.....	.....	55'*	80'*	17'*	.....	Ground support type. 2 built.
	P4M-1	Mercator	Patrol	9	2 P&W R-4360-20W[6]	3250	*2700*	*4800*	2000+	*395*	*15,000*	*30,000*	.....	90,000+	.....	.....	.....	114'	94'	35'	.....	
	P5M-1	Marlin	Patrol	9	2 Wr R-3350-26	3250	*2700*	.....	.....	*270*	.....	.....	.....	*56,000*	.....	.....	.....	.....	88'	.....	.....	PBM-5 Mariner development.
McDonnell Aircraft Corp. St. Louis, Mo.	XF-88	Voodoo	Fighter	1	2 West J34	3000*	.....	.....	1725	700*	SL	40,000	3700	15,000*	.....	65.9	.....	39' 8"	54' 1"	17' 3"	.....	Turboprop version planned.
	F2H-2	Banshee	Fighter	1	2 West J34-WE-22	3000*	.....	.....	.....	575+	SL	45,000+	1270	16,000	.....	.....	.....	41' 6"	40'	14' 6"	.....	Night fighter version has longer nose.
North American Aviation, Inc. Los Angeles Municipal Airport, Los Angeles, Calif.	F-86A	Sabre	Fighter	1	1 GE J47-GE-1	5000	.....	.....	.....	650+	SL	40,000+	.....	*18,000*	*10,000*	.....	.....	37'	37'	14'	.....	Established speed record of 670.98.
	F-86D	Sabre	AW Fighter	1	1 GE J47	5200[9]	.....	.....	.....	650+	SL	*45,000+*	.....	.....	.....	.....	.....	37'	41'	14'	.....	Navy version F2J.
	F-86E	Sabre	Fighter	1	1 GE J47	5200	.....	.....	.....	650+	SL	*50,000**	.....	.....	.....	.....	.....	37'	37'	14'	.....	Redesigned control system.
	YF-93A	.....	AW Fighter	1	1 P&W J48	8000[7]	6250	.....	.....	650+	SL	*50,000*	.....	20,000	*12,000*	.....	.....	39'	44'	16'	.....	Has flush air intakes.
	T-6G	Texan	Trainer	2	1 P&W R-1340-AN-1	600	550	140	870	212	.....	24,750	1295	5617	4271	22.2	9.37	42'	29' 6"	10.8'	258.1	Old T-6s refurbished.
	T-28	.....	Trainer	2	1 Wr R-1300-1	800	700	125	1005[8]	288	5900	29,800	1310	6365	5111	23.8	7.96	40.1'	32'	12.66'	268	Aeroproducts 125" prop.
	AJ-1	.....	Attack	3	2 P&W R-2800-34W[9]	2300	.....	.....	.....	400+	.....	.....	.....	50,000+	34,000+	.....	.....	65'	50'*	.....	.....	Hamilton Standard props.
Northrop Aircraft, Inc. Hawthorne, Calif.	F-89A	Scorpion	AW Fighter	2	2 All J35-A-21	*6000**	.....	.....	.....	600+	.....	40,000+	.....	30,000+	.....	.....	.....	56'	53'	17' 6"	.....	Successor to P-61 Black Widow.
Republic Aviation Corp. Farmingdale, Long Island, N. Y.	F-84E	Thunderjet	Fighter	1	1 All J35-A-17	5000	.....	.....	850[10]	600+	SL	45,000+	.....	23,000*	10,000	.....	.....	37'	38'+	12'+	.....	Over 1000 delivered to USAF.
	F-84F	Thunderjet	Fighter	1	1 All J35-A-25	5200	.....	.....	.....	*650+*	*SL*	.....	.....	25,000	.....	.....	.....	34'*	38'	14'	.....	Sweptwing & tail version of F-84E.
	XF-91	.....	Fighter	1	1 GE J47[11]	5200	.....	.....	.....	*800+*	*SL*	*50,000+*	.....	.....	*12,000*	.....	.....	30'	49'	.....	.....	Inverse taper, swept, variable incidence wings.
Ryan Aeronautical Co. Lindbergh Field San Diego, Calif.	L-17B	.....	Liaison	1-4	1 Con E-185-3	205	185	39.5	500	157	SL	15,600	875	2750	1838	14.6	14.6	33' 4.5"	27' 3"	8' 7.5"	185	Navion for Army Field Forces.
Texas Engrg. & Mfg. Co., Inc. P. O. Box 6191 Dallas 2, Tex.	YT-35	Buckaroo	Trainer	2	1 Fr 6AF-165-B3	165	.....	33	550	150	SL	17,000	925	1975	1385	14.8	11.96	29' 2"	21' 8"	6' 4"	134	Koppers 74" prop.
Chance Vought Aircraft Division of United Aircraft Corp., P. O. Box 5907, Dallas, Tex.	F4U-5	Corsair	Fighter	1	1 P&W R-2800-32	2500	*1500*	234	1500+	450+	SL	42,500	.....	13,300*	10,099	.....	.....	41'	34' 6"	14' 9.5"	.....	Night fighter version in production.
	F7U-1	Cutlass	Fighter	1	2 West J34-WE-32	3000	.....	.....	1000+	*700+*	*SL*	.....	.....	20,000	*13,000*	.....	.....	39'	40'	.....	.....	Later models will have more power.

Italics: Aviation Week estimates.
* Approximate.
All—Allison.
ASW—Anti-submarine warfare.
AW—All weather.
Con—Continental.
Fr—Franklin.
GE—General Electric.
P&W—Pratt & Whitney.
SL—Sea level.
West—Westinghouse.
Wr—Wright.

[1] Plus four GE J47 5200-lb. thrust each turbojets mounted in pairs in pods under each wing.
[2] With tip tanks.
[3] Plus 600 gal. auxiliary fuel.
[4] Later model has Westinghouse J46s of about 6000 lb. thrust each.
[5] Dry static thrust. Afterburner is fitted.
[6] Plus two 4000-lb. thrust plus J33-A-10 turbojets, one in each engine nacelle behind piston engines.
[7] With afterburner in operation; 6250 lb. thrust normally.
[8] Maximum range.
[9] Plus one Allison 4000-lb. thrust plus J33 turbojet mounted in fuselage.
[10] Radius of action. 1100 mi. with bomb pylon tanks.
[11] Plus tail-mounted Reaction Motors 4-cylinder rocket motor of 6,000 lb. thrust.

Aeroquip



AEROQUIP *FLANGE-TYPE* HOSE LINES *

A development to reduce weight, allow more flexibility in power plant and to reduce fire hazard.

Three-piece fitting, each individual part replaceable. Assembly without special tools. No adjustment or tightening after assembly. Fittings can be removed from hose and reused.

Specify these new assemblies for lower cost, more safety, and easy maintenance.

Aeroquip for better performance, maintenance, and service.

AEROQUIP FIRSTS

Self-Sealing Couplings

Detachable Hose Fittings

Hydrofuse

Hydrauliscope

*Another Aeroquip First

AEROQUIP CORPORATION

JACKSON, MICHIGAN

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4301 N. W. 36TH ST., MIAMI SPRINGS, FLORIDA

EDINA BRANCH—BOX NO. 44, MINNEAPOLIS 10, MINN.
303 WAREHAM BLDG., HAGERSTOWN, MD.
72-74 STAFFORD STREET, TORONTO, CANADA

AEROQUIP PRODUCTS ARE FULLY PROTECTED BY PATENTS IN U. S. A. AND ABROAD

Aircraft Production, 1950

Month	NUMBER		AIRFRAME WEIGHT 000 lb.			VALUE (Sales) Million Dollars			TOTAL WEIGHT	TOTAL VALUE
	Personal	Transp.	Military	Pers.	Transp.	Military	Pers.	Transp.	000 lb.	Mill. Dollars
January	157	10	1,456	128	402	322	1.0	11.1	1,986	367
February	217	8	2,829	163	250		1.1	6.8	3,242	
March	322	4	2,764	244	158		1.5	4.2	3,166	
April	322	7	3,432	234	206	296	1.5	4.9	3,872	329
May	370	7	3,089	275	244		1.9	5.9	3,608	
June	358	11	3,154	275	293		2.0	7.4	3,722	
July	311	9	2,437	251	211	N.A.	1.9	4.7	2,899	N.A.
August	331	14	3,523	253	275		1.8	6.1	4,051	
September	286	12	2,829	215	304		1.5	6.6	3,348	
October	189	6	3,180	158	170	N.A.	1.2	3.9	3,508	N.A.
November	215	12	N.A.	175	256		1.3	5.9	N.A.	
December	N.A.	N.A.	N.A.	N.A.	N.A.		N.A.	N.A.	N.A.	
TOTAL*	3,290	110	37,000	2,600	3,000	1,400	18.0	72.0	42,600	1,600

* Estimated
Sources: Census Reports
Aircraft Industries Assn.

—Table by Rudolf Modley

Big Year Behind and Bigger Year Ahead

But great part of future output is slated to come from non-aviation firms.

The year 1951 is potentially the biggest in U. S. aircraft production, poundswise, since 1944, the peak production year of World War II.

With $9.6-billion appropriated for domestic Air Force and Navy aviation procurement, plus $1.1 billion earmarked for aviation aid to our North Atlantic allies, virtually every major U. S. company already has a huge backlog of military orders committed or in negotiation.

But there are some very sizeable "ifs" about whether or not the dollar profits in 1951 for the established aircraft companies will parallel the increase in airframe weight.

▶ **The Questions**—Some of the big uncertainties ahead are:

- **How much** of its huge orders will the established aviation industry make in its own plants; how much will go outside to licensee companies and subcontractors?
- **How soon** can the increased production start rolling to turn out the enlarged program called for?
- **What limitations** will renegotiation put on operating margins?
- **How severely** will earnings be held down by higher taxes and what will the "depressed industry" clause in the new tax law mean in excess profit tax relief for the individual company?
- **How much** will anticipated obstacles such as materials and manpower shortages, and some tool and plant facility shortages slow up production schedules?

Department of Defense policy to spread the manufacturing base for military contracts, to insure a greater production potential for rapid war mobilization, is a new factor which has shattered the dreams of a number of established aircraft companies for immediate vast expansion of production and consequent increased profits.

▶ **Outside Help**—As in World War II, the automobile manufacturers are being called in to participate in production in excess of the present plant capacities of the aircraft companies. Ford Motor Co. will build the Pratt & Whitney R-4360 Wasp Major piston engine under license in Chicago; Kaiser-Frazer Corp. will build Fairchild's C-119C cargo transport at Willow Run; Chrysler will make the Pratt & Whitney J-48 jet engine in a new plant; Studebaker will build the General Electric J-47 engine; General Motors will build the Republic F-84F jet fighter at Kansas City. One other important licensing program already disclosed, is between two aircraft companies: Douglas will build the Boeing B-47 jet bomber at Tulsa.

And in addition to the licensing agreements, production of the huge aircraft orders placed in 1951 is being fanned out among an increasingly large number of subcontractors, many of whom have not made aviation parts and equipment since World War II.

Defense Department is working toward a goal to have at least two sources of supply for each major plane, powerplant and principal component so that a successful enemy attack on any one

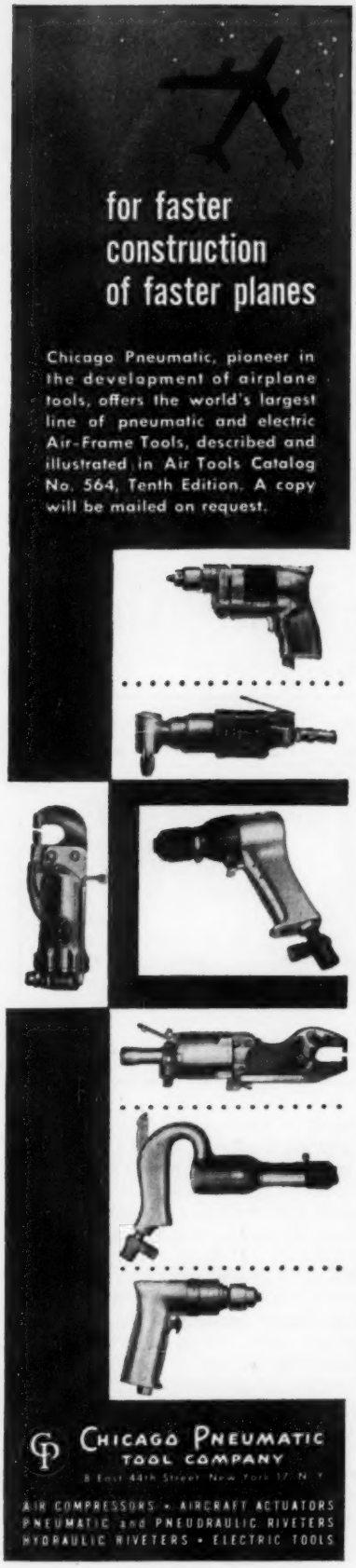
(Continued on page 29)

Engine Production, 1950

Month	MILITARY		CIVIL			TOTAL HORSEPOWER[a]	TOTAL[b] SALES
	000 Hp.[a]	Mill. Doll.	Number	000 Hp.	Mill. Doll.	000's	Mill. Doll.
Jan.	4,183	120	266	140	1.8	4,323	136
Feb.	3,036		208	101	1.3	4,037	
Mar.	4,872		357	133	1.7	5,005	
Apr.	4,029	120	479	153	1.7	4,182	136
May	4,320		337	168	2.1	4,488	
Jun.	4,657		432	173	2.0	4,829	
Jul.	4,477	N.A.	376	143	1.7	4,620	N.A.
Aug.	4,805		392	99	1.0	4,904	
Sep.	4,432		415	119	1.3	4,550	
Oct.	5,007	N.A.	340	83	.9	5,090	N.A.
Nov.	N.A.		350	144	1.8	N.A.	
Dec.	N.A.		N.A.	N.A.	N.A.	N.A.	
TOTAL[c]	55,000	500	4,300	1,600	19.5	58,600	600

[a] Thrust of jet engines converted to horsepower.
[b] Includes parts and research and development contracts.
[c] Estimated.
N.A. Not Available.
Source: Census Reports.

Table by Rudolf Modley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of faster planes
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U. S. Aircraft Production History

1909–1939

Year	NUMBER			VALUE Million Dollars		
	For U. S. Military	Civil and other	Total	Military Aircraft	Civil Aircraft	Total Incl. Parts
1909	1	.....	1	N.A.	N.A.	N.A.
1910	N.A.	.....	N.A.	N.A.	N.A.	N.A.
1911	11	.....	11	N.A.	N.A.	N.A.
1912	16	29	45	N.A.	N.A.	N.A.
1913	14	29	43	N.A.	N.A.	N.A.
1914	15	34	49	N.A.	N.A.	.8
1915	26	152	178	N.A.	N.A.	N.A.
1916	142	269	411	N.A.	N.A.	N.A.
1917	2,013	135	2,148	N.A.	N.A.	N.A.
1918	13,991	29	14,020	N.A.	N.A.	N.A.
1919	682	98	780	N.A.	N.A.	14.4
1920	256	72	324	N.A.	N.A.	N.A.
1921	389	48	437	N.A.	N.A.	7.4
1922	226	37	263	N.A.	N.A.	N.A.
1923	687	56	743	N.A.	N.A.	13.1
1924	317	60	377	N.A.	N.A.	N.A.
1925	445	344	789	N.A.	N.A.	12.8
1926	478	708	1,186	10.3	N.A.	17.7
1927	609	1,386	1,995	14.1	N.A.	30.9
1928	847	3,499	4,346	31.5	18.2	64.7
1929	779	5,414	6,193	19.4	51.5	91.1
1930	836	2,601	3,437	21.5	17.0	60.8
1931	853	1,947	2,800	23.4	10.8	48.5
1932	500	896	1,396	16.8	5.2	34.9
1933	331	993	1,324	14.8	10.9	33.4
1934	393	1,222	1,615	14.0	20.3	43.9
1935	336	1,374	1,710	17.6	16.9	42.5
1936	858	2,152	3,010	42.4	19.9	78.1
1937	858	2,915	3,773	51.9	34.5	114.1
1938	925	2,698	3,623	N.A.	N.A.	198.3
1939	921	4,935	5,856	N.A.	N.A.	247.9

1940–1950

Year	NUMBER			VALUE (Aircraft, Engines, Propellers & Parts) Million Dollars		
	Military	Civil	Total	Military	Civil	Total
1940	6,019	6,785	12,804	600*	50*	650*
1941	19,433	6,844	26,277	1,804	50*	1,854*
1942	47,836	.....	47,836	5,817	.....	5,817
1943	85,898	.....	85,898	12,514	.....	12,514
1944	96,318	.....	96,318	16,047	.....	16,047
1945	47,714	2,047	49,761	9,000*	10*	9,010*
1946	1,869	35,001	36,670	800*	200*	1,000*
1947	2,100*	15,617	17,717*	750*	250*	1,000*
1948	2,300*	7,302	9,600*	1,125*	175*	1,300*
1949	2,500*	3,600*	6,100*	1,300*	200*	1,500*
1950	3,000*	3,400*	6,400*	2,000*	200*	2,200*

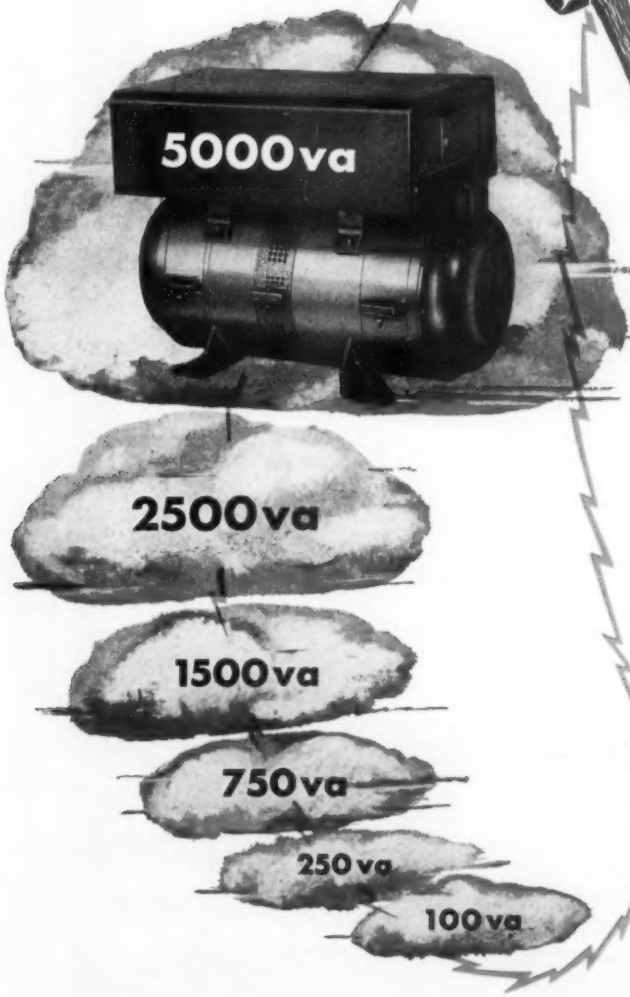
N.A. Not Available.
* Estimated.
Military values 1940–1944 based on 1943 unit cost.
Sources: Aviation Facts and Figures.
Statistical Handbook of Civil Aviation, 1949.
Census Reports.

—Table by Rudolf Modley

no MYTH

...to controlled electrical power

The Legend of THOR—mythical Norse God
Thor was conceived in his character as a God of strength, a helper in war and a defender of peace. He was a red-bearded, red-haired youthful giant, armed with a magic hammer which he would cast at clouds, causing a mighty discharge of lightning and thunder.



. . . the ancients may have had to believe in myths and magic to explain the wonders of electrical power. There is no myth or magic about Eicor's development of electronically controlled inverters. It has been proven from laboratory reports, tests in the field and thousands of actual flying hours that by sound, imaginative engineering, we have produced dependable, sensitively controlled power conversion equipment to meet the most stringent of specifications. By designing and manufacturing a wide range of inverter sizes, we can now offer the aircraft industry a complete power conversion picture. BE WISE, specify an EICOR Electronically Controlled Inverter as the solution to your toughest power conversion problems.

Eicor inverters are designed for conversion of 26-29 volts DC and 110-120 volts DC input to 115 volts AC output, single or three phase, 400 cycle power.

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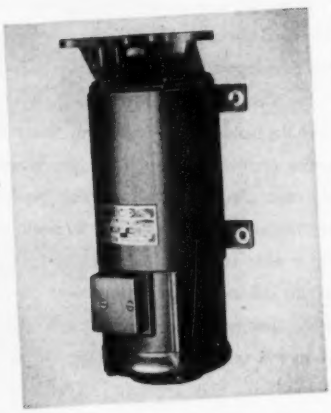
EEMCO technical bulletin

Unconventional Hydraulic Pump Motor Saves Weight... Increases Efficiency

Hydraulic pump motors normally operate through a reduction to achieve pump speeds of 3 - 4000 R.P.M. Illustrated at the left is a new motor designed for high-speed pumps which requires no such reduction. Developed by EEMCO in cooperation with the designers and builders of leading aircraft, this motor was designed for an allowable pump speed of 7200 R.P.M. The motor mounts directly on the pump with an internal spline drive within the armature shaft providing the coupling.

Use of this new unit achieves significant savings in weight, increases efficiency by eliminating gear loss and makes for a more compact assembly.



New emergency standby motor for use on Supersonic Research Aircraft

Another new EEMCO development, the explosion proof motor illustrated, was designed to operate under high ambient temperatures of 70°C at 50,000 ft. altitudes. Duty cycle is 1 minute at 1 h.p., 30 seconds at 2½ h.p., continuous. High temperature materials and silicone insulation are used throughout. Motor weight, including gear box - 22½ lbs.

EEMCO Design and Testing Service Solves Difficult Actuator and Motor Design Problems... Tell us your requirements on current motor or actuator design problems. Include preliminary data on type of unit, specific function, special requirements, operating conditions, motor and actuator specifications and any available drawings, diagrams and tables.

3

SEND YOUR NAME FOR PERFORMANCE CHARTS AND DESIGN DRAWINGS... *Executives, Engineering and Design personnel making request on company letterhead will be placed on mailing list for performance and design drawings of EEMCO designs for file and reference.*

EEMCO

ELECTRICAL ENGINEERING and MFG. Corp.

4612 W. Jefferson Blvd., Los Angeles 16, California

U. S. Aircraft Industry*

Company	Location	Plant Area Sq. Ft.	Plant Employment	1950 Sales[1]	Backlog[1]
Aeroproducts Div.—GM	Vandalia, Ohio	201,600	1,528	NA	NA
Allison Div.—GM	Indianapolis, Ind.	4,000,000	10,000	NA	NA
Beech Aircraft Corp.	Wichita, Kan.	1,250,000	5,000	$21,000,000	$50,000,000[2]
Bell Aircraft Corp.	Buffalo, N. Y.	1,880,000	7,882	40,000,000	150,000,000[3]
Boeing Airplane Co.	Seattle-Renton, Wash.	1,881,365	24,400	207,606,569	NA
Cessna Aircraft Co.	Wichita, Kan.	2,175,790	18,180		
	Wichita, Kan.	542,000	2,200	7,158,499	40,000,000
	Hutchinson, Kan.	113,251[3]	200		
	Prospect, Kan.	160,000	200		
Chase Aircraft Co.	West Trenton, N. J	200,000	1,200	NA	NA
Consolidated Vultee Aircraft Corp.	San Diego, Calif.	3,000,000[3]	16,000	250,000,000[3]	250,000,000
	Ft. Worth Texas	4,0000,000	26,000		
Curtiss-Wright Corp.	Caldwell, N. J.	800,000	4,500[3]	150,000,000	300,000,000
	Wood-Ridge, N. J.	2,827,550[3]	10,000[3]		
Douglas Aircraft Co.	Santa Monica, Calif.	941,404	10,200	100,000,000[4]	625,000,000[4]
	El Segundo, Calif.	594,532	7,700		
	Long Beach, Calif.	788,486	9,800		
Fairchild E & A Corp.	Hagerstown, Md.	900,000	5,000	NA	NA
	Long Island, N. Y.	600,000	2,000		
General Electric Co. (Aircraft Gas Turbine Div.)	West Lynn, Mass.	737,000	5,870		
	Everett, Mass.	239,000			
Grumman Aircraft Engineering Corp.	Lockland, Ohio	4,000,000[3]	10,000[3]		
	Bethpage, N. Y.	1,523,685	6800	NA	NA
Hiller Helicopters, Inc.	Palo Alto, Calif.	61,500	300	NA	4,000,000[5]
Kaman Aircraft Corp.	Windsor Locks, Conn.	22,800[3]	165	NA	2,000,000[5]
Lockheed Aircraft Corp.	Burbank, Calif.	NA	NA	170,000,000	425,000,000
Glenn L. Martin Co.	Middle River, Md.	2,400,000	11,500	40,500,000	175,000,000[6]
McDonnell Aircraft Corp.	St. Louis, Mo.	1,590,711	7,000[3]	38,688,383[11]	180,000,000
North American Aviation Inc.	Los Angeles, Calif.	2,915,841	13,795	143,032,357[7]	311,270,388[8]
	Long Beach, Calif.	500,223	1,927		
	Downey, Calif.	974,676	4,770		
	Torrance, Calif.	149,721	322		
	Columbus, Ohio	1,408,693	2,421		
Northrop Aircraft, Inc.	Hawthorne, Calif.	1,461,490	9,000[3]	52,224,513	180,000,000
Piasecki Helicopter Corp.	Morton, Pa.	250,000	1,650	8,000,000	90,000,000
Republic Aviation, Inc.	Farmingdale, N. Y.	1,650,000	7,700[3]	43,021,000[4]	270,000,000[4]
Ryan Aeronautical Co.	San Diego, Calif.	640,000	3,000	12,500,000	25,000,000[3]
United Aircraft Corp.	East Hartford, Conn.	2,847,000[3]	20,000	192,268,229[4]	700,000,000[4]
	Southington, Conn. (Pratt & Witney)	500,000	4,000[10]		
	East Hartford, Conn. (Hamilton Std. Div.)	500,000[3]	(9)		
	Dallas, Texas (Chance Vought)	1,800,000[3]	(9)		
	Bridgeport, Conn. (Sikorsky Div.)	325,730[3]	(9)		
TOTALS		49,354,084[3]	306,210[3]	1,475,999,550	3,777,270,388

* Prime engine and airframe contractors for the services with exception of Westinghouse Electric Corp. which did not furnish data before closing date.
[1] Aviation Week estimate.
[2] Estimated as of Jan. 1, 1950.
[3] Fiscal year ending Nov. 30, 1950.
[4] Nine months to Sept. 30, 1950.
[5] 527,553 sq. ft. of total for N. J. Woolen Mill purchased Jan. 31, 1951.
[6] As of Dec. 31, 1950.
[7] Fiscal year ending Sept. 30, 1950.
[8] Estimated when expansion completed.
[9] Included in UAC total employment of 34,000.
[10] Planned employment under future operations.
[11] Fiscal year ending June 30, 1950.

Source: Manufacturers' reports and Aviation Week estimates.

Floor Space

(Millions of square feet)

	Airplane	Engine	Propeller	TOTAL
Jan. 1939	7.5	1.7	.3	9.5
Sep. 1941	31.8	10.7	1.7	44.2
Dec. 1943	110.4	54.2	6.8	171.4
1947*	39.0	13.5	1.6	54.1
1950*	47.5	14.0	2.0	63.5

Note: Excludes standby plants and plants not used for aeronautical production.
* Estimated.
Source: 1939-1943: Aviation Facts and Figures; prime contractors only.

Table by Rudolf Modley

plant will not knock out a complete program.

▶ **Government Role**—New sources of supply is not all that is needed to make the Defense Department's mobilization plans work. New government agencies have been created, new jobs given to existing agencies.

Air Materiel Command's Industrial Planning Division has entered into the second phase of its program, to serve as a Production Resources Division for the Air Force contractors in their expansion. Approximately 40,000 govern-

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SERVICE!
SELECTION!

MAKE *hi-shear*
THE FASTENER
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Six times as many shear pounds per man hour are gained using HI-SHEARS as compared to regular rivets or bolts.

SERVICE

HI-SHEARS are ideal fasteners for engine mounts, cannon and gun mounts and supporting structure where resistance to vibration must be met. Vibration resistance is inherent in the HI-SHEAR principle of swaging the collar into the pin end. HI-SHEARS serve as "tamper-proof" fasteners, to be serviced only by authorized personnel.

SELECTION

HI-SHEARS are being used in standard diameters of 1/8 through 5/8 inches and allow unlimited range in lengths. HI-SHEARS are in styles and materials adaptable to ANY high strength fastener problem.

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QUIETS
Jet and reciprocating Engine Test Cells
Ends { ANNOYANCE / COMPLAINTS / THREATS of LEGAL ACTION
due to disturbing
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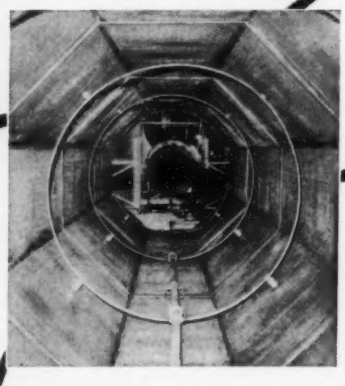

Interior of ISC Jet Aircraft Muffler

The roar of jet tests need no longer be an aircraft engine and air frame manufacturing problem!

Industrial Sound Control
JET AIRCRAFT MUFFLERS AND PANELS

cut the roar of jets to the level of surrounding neighborhood noises.

ELIMINATES EXCESSIVE WATER CONSUMPTION

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INDUSTRIAL SOUND CONTROL
45 Granby St., Hartford, Conn.
2119 Sepulveda Blvd., Los Angeles, Calif.

Engine Production, 1940–1950

Year	MILITARY		CIVIL		TOTAL		VALUE
	Number	Mill. Hp.*	Number	Mill. Hp.	Number	Mill. Hp.	Million Dollars
1940	22,667	15.5	7,500*	1.0*	30,000*	16.5*	125*
1941	58,181	44.9	6,500*	1.0*	65,000*	46.0*	436
1942	138,089	147.5	.....	....	138,089	148*	1,314
1943	227,116	262.3	.....	....	227,116	263*	2,226
1944	257,000*	370*	.....	....	257,000	370*	3,075
1945	109,650	190*	2,000*	N.A.	112,000	190*	1,750*
1946	2,585	9*	40,822	12.0*	43,404	21.2*	N.A.
1947	4,808	17.1	16,351	5.1	21,159	22.2	463[b]
1948	N.A.	22.0	9,039	2.8	N.A.	24.8	N.A.
1949	N.A.	45.4	3,987	1.2	N.A.	46.7	N.A.
1950	N.A.	55.0*	4,300*	1.6	N.A.	56.6*	600*

N.A. Not Available.
* Estimated.
* Thrust of jet engines converted to horsepower.
[b] About $80 million of this was for research and experimental work.
Source: Aviation Facts and Figures. Census Reports.

Table by Rudolf Modley

Airframe Weight Produced

1940-1950

Year	WEIGHT IN MILLION POUNDS (Excl. Spares)		
	Military	Civil	Total
1940	23.1	4.0*	27.1*
1941	76.1	4.0*	80.1*
1942	253.1	....	253.1
1943	645.9	....	645.9
1944	963.2	....	963.2
1945	540.0*	1.5*	541.5*
1946	12.9	25.5	38.4
1947	11.4	17.9	29.3
1948	25.2	10.1	35.3
1949	29.8	6.7	36.5
1950	37.0*	5.6*	42.6*

* Estimated.
Source: Aviation Facts and Figures.
Census Reports.

—Table by Rudolf Modley

Propellers Produced

1940-1950

Year	Military	Civil	Total	Value Mill. $
1940	14,290	.....	.....	25*
1941	39,123	.....	.....	63
1942	106,136	.....	106,136	191
1943	213,937	.....	213,937	347
1944	243,741	.....	243,741	407
1945	96,490	2,000*	98,500*	210*
1946	846	N.A.	N.A.	N.A.
1947	2,738	41,113	43,851	N.A.
1948	37,943	23,004	60,947	51.0
1949	45,770	11,343	57,113	57.6
1950*	N.A.	10,000*	N.A.	75.0*

* Estimated.
Sources: Statistical Handbook of Civil Aviation, 1949.
Aviation Facts and Figures.
Census Reports.

—Table by Rudolf Modley

Estimated Consumption of Selected Materials by the Aircraft Industry (Including Engines) per Pound of Airframe Weight Produced.

MATERIAL	CONSUMPTION PE LB.	BASE OF CALCULATION		Year
		Total Consumption in aircraft prod.	Estimated Airplane Weight—Mill. lb.	
Steel Mill Shapes & Forms	4.5 lb.	45,500 short tons	20	1947
Carbon Steel	2.1 lb.	21,500 short tons	20	1947
Stainless Steel	1.2 lb.	11,900 short tons	20	1947
Other Steel Alloys	1.2 lb.	12,100 short tons	20	1947
Copper & Copper Base Alloy	.06 lb.	632 short tons	20	1947
Aluminum Mill Shapes	2.0 lb.	29,601 short tons	29	1947
Aluminum Castings	.4 lb.	4,335 short tons	20	1947
Aluminum	4.2 lb.	627,700 short tons	296	Apr.-Jun. 1944
Alloy Steel	2.2 lb.	340,200 short tons	296	Apr.-Jun. 1944
Copper & Copper Base Alloys	.3 lb.	42,300 short tons	296	Apr.-Jun. 1944
Fractional Horsepower Motors	44 (per plane)	4,210,000	96,318 planes	1944
Antifriction Bearings	585 (per plane)	56,400,000	96,318 planes	1944

Source: Aviation Facts & Figures.
Census of Manufacturers.

Table by Rudolf Modley

ment-owned machine tools in storage since World War II are being distributed to manufacturers under lease. Numerous Air Force and Navy industrial reserve plants have been reactivated and others will be put into use soon.

A key organization in determining materials priorities will be the Aircraft Production Resources Agency, also located at AMC headquarters, which will serve as a joint scheduling unit for critical materials for Air Force Navy and Army.

Manpower problems and many other production problems will fall under the Office of Defense Mobilization headed by Charles E. Wilson, War Production Board boss in World War II, and most of these will be delegated to the National Production Authority which is part of this office.

▶ **Past Help**—To bolster the aviation industry in its new expansion, is a background of three increasingly good years just completed.

Dollar sales volume of the 15 large

"...a superb engineering achievement"

says Vance Breese

August 5, 1950
1535 N. Dohney Drive
Los Angeles 46, California

LEAR, Inc.
Grand Rapids, Michigan

Gentlemen:

The LEARAVIAN has been a most satisfying investment. It has proven useful in many unexpected ways. In addition to supplying local and airways weather reports, I find that when planning transcontinental trips it is practical to listen to approach control and airliners en route (on the Marine band) from Honolulu to Chicago, thereby getting a fairly clear picture of conditions over a three thousand mile radius. This performance is all the more remarkable to me in that it operates on the built-in antenna, although my home is in a deep canyon in the Hollywood Hills, where reception is normally very difficult. The reception has proven completely dependable, either on external power or batteries.

The battery re-charging feature has eliminated the "dead battery" bugaboo that seemed always to occur when a set was most urgently needed. My business use of the BONANZA frequently takes me off Airways where the rural phone service is rather slow. The LEARAVIAN provides me with the certainty of latest reports from the range stations that are so essential to safe and proper use of business aircraft.

The Broadcast band provides a large range of stations carrying news and entertainment that is most welcome, especially in remote locations where many other radios fail to provide reliable reception.

My heartiest congratulations on a superb engineering achievement.

Sincerely,

Vance Breese

/s/ Vance Breese

MEET VANCE BREESE

famed aviation engineer and test pilot extraordinary. Mr. Breese served as consultant on design and flight test problems for Bell, Brewster, Curtiss, Douglas, Fairchild, Lockheed, North American, Northrop, Vultee, and other companies with whom he contributed to the development of many hundreds of airplanes. He conducted the first flights of the Mustang, Northrop Wing, Black Widow, Mitchell B-25 Bomber and many others.

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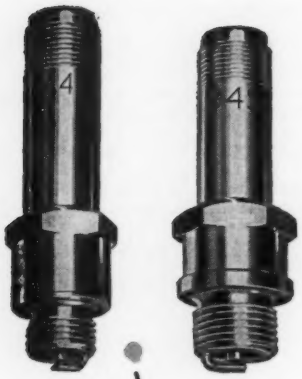
Lear



14MM AND 18MM
SHORT REACH SHIELDED

The Auto-Lite A4S and B4S Aircraft Spark Plugs are medium priced for light aircraft use. These plugs, combined with shielded harness, reduce radio interference, help get dependable operation at lower costs. The famous Auto-Lite one-piece construction of these plugs permits sale below prices of other shielded plugs.

18MM AUTOMOTIVE TYPE

New low cost aircraft spark plug especially designed by Auto-Lite for light plane use. Here is a high quality 18MM Aircraft Spark Plug with automotive type electrodes—built to give long life and low cost service.

18MM SHORT REACH SHIELDED

The SH2K Aircraft Spark Plug was especially designed by Auto-Lite to give long life service under the most severe operating conditions. Suitable for higher power engines requiring a superior type of shielded spark plug up to 1,000 H.P. Money cannot buy a better shielded spark plug.

AUTO-LITE *Aircraft* SPARK PLUGS

C.A.A. APPROVED FOR ENGINES AS SPECIFIED

18MM SHORT REACH UNSHIELDED

Auto-Lite developed the 18A-1 for the most rigid requirements of civilian aircraft. This precision-made 18MM plug has ball type terminal, multiple electrodes, one-piece shell design, corundum insulator.

NEW RESISTOR PLUG REDUCES RADIO, RADAR INTERFERENCE

The new Auto-Lite Resistor Spark Plug reduces radio communication and radar interference normally caused by ordinary spark plugs. Get smoother performance — money-saving gas economy — improved starting in cold weather. Install this sensational plug on all your ground equipment.

THE ELECTRIC AUTO-LITE COMPANY
Sarnia, Ontario — Toledo 1, Ohio
Auto-Lite Spark Plugs—Patented U.S.A.

A request on your company letterhead will bring your copy of our special Aircraft Spark Plug Catalog packed with useful information such as latest C.A.A. and Engine Manufacturer's type specifications, service instructions and other vital facts.

Average Airframe Weight

Military Aircraft

1940	3800 Lb.
1941	4000 Lb.
1942	5300 Lb.
1943	7500 Lb.
1944	10,000 Lb.
1945	11,000 Lb.
1946	7100 Lb.
1947	5400 Lb.
1948	11,000 Lb.*
1949	12,000 Lb.*
1950	12,300 Lb.*

*Estimated

Source: Aviation Facts and Figures Census Reports

—Table by Rudolf Modley

airframe engine and propeller companies for 1950 has been estimated at approximately $2 billion, as compared to $1.5 billion reported by the same companies for 1949.

• **Military.** Bulk of the increase was in military production. Airframe weight of military aircraft delivered in 1950 was approximately 37 million lb. compared to 29.8 million lb. delivered in 1949. In numbers this was estimated at 3000 planes for 1950 as compared to about 2500 in 1949.

• **Transport.** Uncertainties of future availability of commercial transport planes due to military priorities has led to an increasing number of new transport plane orders, which did not show up in the 1950 deliveries but will be a factor in 1951, and 1952. Total transport production of 97 for 1950 compared to about 166 in 1949, and 263 in 1948. But unfilled orders at the end of 1950 for transports totaled 260 (including some 50 ordered off-the-shelf by Air Force and Navy). It is estimated that nearly 200 of these will be delivered

Labor Turnover Per 100 Employees, 1950

	Accessions	Separations	Net Gain or Loss
AIRCRAFT			
Jan.	3.0	2.8	.2
Feb.	2.1	3.6	−1.5
Mar.	3.4	2.7	.7
Apr.	3.1	2.5	.6
May	3.2	2.4	.8
Jun.	4.0	2.6	1.4
Jul.	5.3	2.2	3.1
Aug.	10.5	3.6	6.9
Sep.	8.7	4.8	3.9
Oct.	8.7	3.6	5.1
Nov.	6.9	2.8	4.1
Dec.	N.A.	N.A.	N.A.
AIRCRAFT ENGINES & PARTS			
Jan.	1.6	1.7	−.1
Feb.	1.7	1.3	+.4
Mar.	1.6	1.4	.2
Apr.	1.6	2.3	−.7
May	2.3	1.4	.9
Jun.	3.0	1.4	1.6
Jul.	3.8	1.0	2.8
Aug.	6.5	2.0	4.5
Sep.	7.1	3.0	4.1
Oct.	6.4	2.0	4.4
Nov.	6.1	1.8	4.3
Dec.	N.A.	N.A.	N.A.

Source: Bur. of Lab. Statistics.

—Table by Rudolf Modley

6 of 17
NEW
AMPHENOL
RF CONNECTORS
Illustrated here are 6 of the 17 new Amphenol RF Connectors which are featured in the current issue of *AMPHENOL ENGINEERING NEWS.
Among the 17 new connectors in the "UHF" series are 2 cable-to-connector fittings and one right angle adaptor, which has a lower V.S.W.R. than previously available, also a type "HN" angle plug approximately 40% lighter than the usual adaptor-plug combination. Of particular interest are five new connectors; Teflon insulated for lowest possible dielectric losses and satisfactory operation up to temperatures as high as 500° F. Also added to the line are 4 new pressurized panel receptacles and new Wright Field modified type "N" plugs, jacks, panel jacks and bulkhead panel jacks.
Don't miss the Volume 3, No. 10 issue of AMPHENOL ENGINEERING NEWS for complete descriptions and data on these new Amphenol RF Connectors.
* Amphenol Engineering News brings you in this issue complete information on these 17 new RF Connectors, providing specifications and dimensional data preliminary to cataloging. Request this issue of Amphenol Engineering News.
AMPHENOL
AMERICAN PHENOLIC CORPORATION
1830 SO. 54TH AVENUE • CHICAGO 50, ILLINOIS

Add up all these Hufford

IT'S STRETCH-WRAP FORMING AT IT'S BEST!

Looking for a fast, accurate method of forming parts made of sheet stock or extruded shapes? You'll find it in HUFFORD Stretch-Wrap Forming!

IT'S A TIMESAVER!

Not only because of high output rate, but because Hufford-formed parts usually require no second operations such as straightening, planishing, heat-treating, refrigerating, crown rolling, and drop hammer work.

IT'S VERSATILE!

Hufford Stretch-Wrap Forming uses a variety of tooling, is easily adapted to the formation of oddly-shaped parts, is suitable for forming both skins and structural members—usually on the same machine.

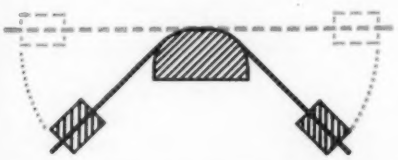
IT'S ECONOMICAL!

Because of Hufford's balanced stretching from each end, yield is more uniform and under better control over the entire part. Breakage is consequently almost nil, cutting wastage and material losses.

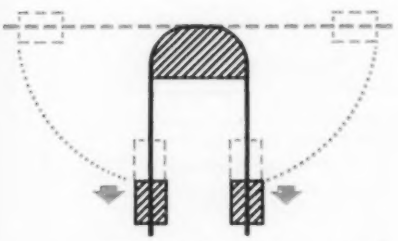
IT'S ACCURATE!

Because parts are so uniform, the forming die itself can frequently be used as a check tool. This exceptional accuracy reduces hand fitting and cuts assembly costs.

Tension is applied before work is formed. Initial yield is thus uniform over entire part.

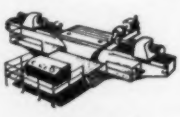


After correct yield is obtained, tension is held constant and maintained while part is wrapped around die.

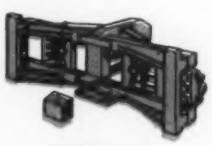


Upon completion of the wrap, final "setting" tension is pulled from each side of die center. *Stretch is thus more uniform over entire work piece, more nearly equalizing stresses and reducing breakage hazards.*

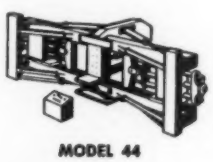
MODEL A-10



MODEL A-15

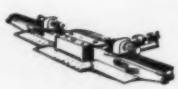


MODEL 46

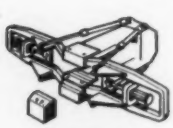


MODEL 44

MODEL A-5



MODEL A-12



MODEL 50

Also available MODEL A-7, MODEL 60

advantages!

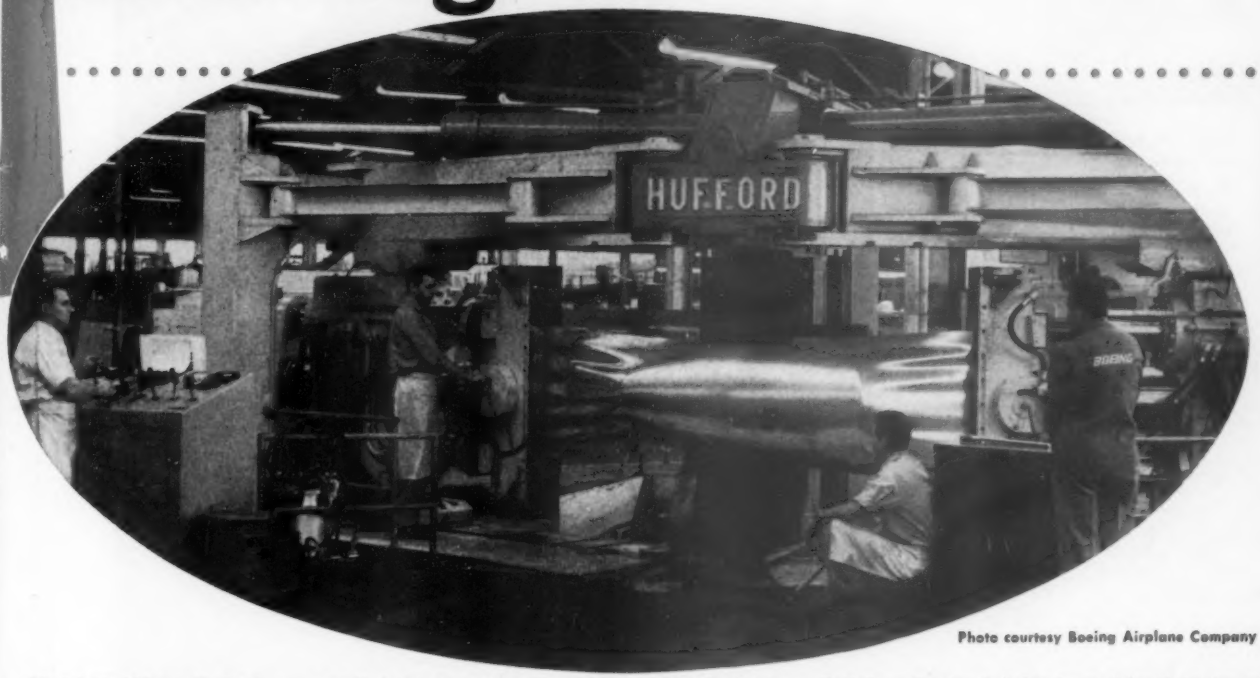


Photo courtesy Boeing Airplane Company

Model 46, 150-ton Hufford, now installed at Boeing Airplane Company, Wichita Division. Tail Cone Section is being formed for B-47 Stratojet.

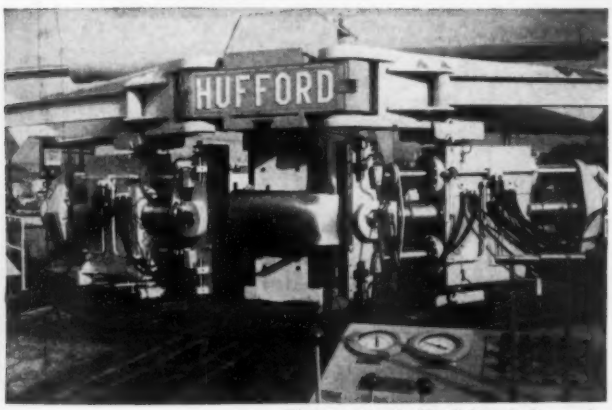


Photo courtesy Lockheed Aircraft Corporation

Model 44, 200-ton Hufford used by Lockheed Aircraft Corporation at Burbank, California.

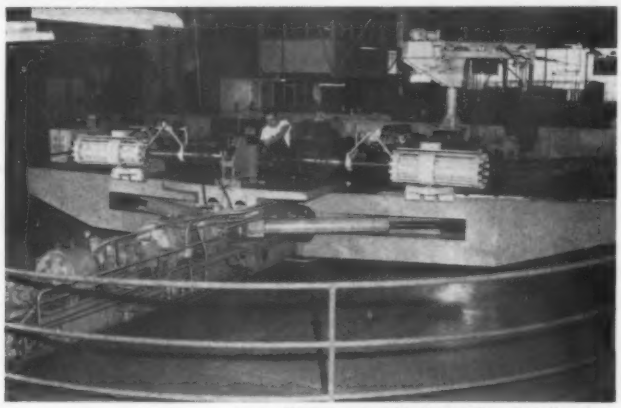


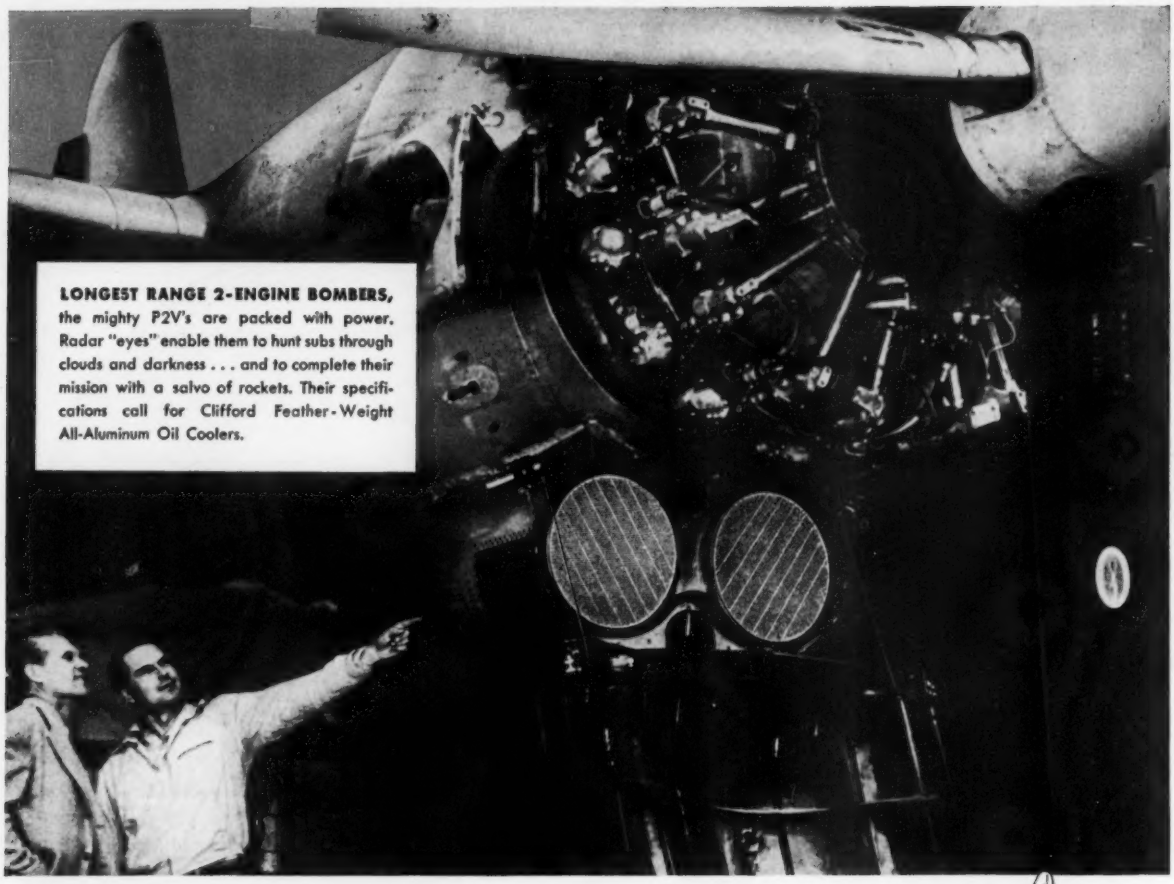
Photo courtesy North American Aviation, Inc.

Model A-12, 60-ton Hufford recently installed at North American Aircraft, Inglewood, California. This is Hufford's newest high-production, semi-automatic model with push-button control and independent arm action.

Whatever your forming problem, you'll find the advantages with Hufford—And Hufford now offers the widest selection of machine sizes, tonnages, and work capacities in its history, meeting both today's and tomorrow's stretch-wrap forming requirements. May we send our catalog?

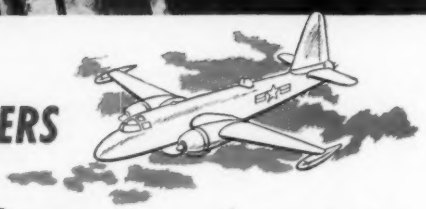
Hufford MACHINE WORKS, INC.
207 NORTH BROADWAY
REDONDO BEACH, CALIFORNIA

Manufacturers of HYDRAULIC STRETCH-FORMING EQUIPMENT • PORTABLE HYDRAULIC ELEVATORS • STRETCH LEVELING TABLES • HYDRAULIC TILE PRESSES • CUSTOM MACHINE TOOLS • SPECIAL HYDRAULIC APPLICATIONS



LONGEST RANGE 2-ENGINE BOMBERS, the mighty P2V's are packed with power. Radar "eyes" enable them to hunt subs through clouds and darkness . . . and to complete their mission with a salvo of rockets. Their specifications call for Clifford Feather-Weight All-Aluminum Oil Coolers.

LOCKHEED'S P2V NAVY PATROL BOMBERS



Cool Their Oil With Feather-Weights

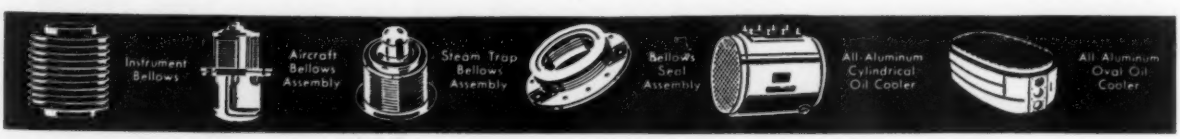
Modern aircraft of all types — conventional or jet powered — rely on Clifford Feather-Weight All-Aluminum Oil Coolers . . . *the only all-brazed type of oil cooler.* Famous Feather-Weights achieve a remarkable weight strength ratio thanks to Clifford's patented brazing method and accurate pre-testing in Clifford's wind tunnel laboratory . . . the largest and most modern in the aeronautical heat exchanger industry. Your inquiry is invited. CLIFFORD MANUFACTURING COMPANY, 136 Grove Street, Waltham 54, Massachusetts. *Division of Standard-Thomson Corporation.* Sales offices in New York, Detroit, Chicago, Los Angeles.

CLIFFORD

HYDRON Metal Bellows

ALL-ALUMINUM OIL COOLERS
FOR AIRCRAFT ENGINES

HYDRAULICALLY-FORMED BELLOWS
AND BELLOWS ASSEMBLIES



Total Employment in Airframe, Engine and Propeller Plants

Year	Airframe	Engine	Propeller	Total
1914	N.A.	N.A.	N.A.	168
1919	N.A.	N.A.	N.A.	3,543
1921	N.A.	N.A.	N.A.	1,395
1923	N.A.	N.A.	N.A.	2,901
1925	N.A.	N.A.	N.A.	2,701
1927	N.A.	N.A.	N.A.	4,422
1929	N.A.	N.A.	N.A.	14,710
1931	N.A.	N.A.	N.A.	9,870
1933	N.A.	N.A.	N.A.	7,616
1935	N.A.	N.A.	N.A.	11,384
1937	N.A.	N.A.	N.A.	30,384
1939	N.A.	N.A.	N.A.	48,638
Jan. 1940	59,000	16,000	2,500	77,500
Jan. 1941	146,197	41,329	6,609	194,135
Jan. 1942	341,603	104,156	14,597	460,356
Jan. 1943	770,471	219,084	38,359	1,027,914
Jan. 1944	931,001	337,698	57,164	1,307,953
Jan. 1945	723,850	286,233	48,153	1,058,236
Jan. 1946	146,602	N.A.	N.A.	180,000*
Jan. 1947	163,521	33,348	N.A.	205,000*
Jan. 1948	148,062	32,953	8,136	189,151
Jan. 1949	166,506	39,846	8,247	214,599
Jan. 1950	163,145	39,961	8,377	211,483
Jan. 1951	230,000*	52,000*	10,000*	292,000*

* Estimated.
1914–1935: Average Number of Wage Earners; Engine Plants excluded.
1937–1939: Average Number of Wage Earners; Engine Plants included.
1940–1945: Prime Contractors.
1946–date: Plants reporting to census Bureau

Table by Rudolf Modley

Unions in the Aircraft Industry

Plants	PLANTS		Percent of Employees in Union	PERCENT OF UNIONIZED EMPLOYEES IN		
	With Unions	Without Unions		CIO	IAM	Other
Airframes	24	9	90.7*	44.9	53.8	1.3
Engines	10	5	97.5	57.3	42.7	....
Propellers	5	3	93.4	15.4	84.4	.2

* 1948 data revised to include Boeing Seattle and Chance Vought Dallas as unionized.
Source: AIA Walsh-Healey Act Brief, p. 37.

Table by Rudolf Modley

Average Weekly Hours

Year	Aircraft excl. engines	Aircraft Engines
1939	41.5	44.1
1940	43.2	45.8
1941	45.3	46.9
1942	47.0	48.7
1943	46.4	47.4
1944	47.1	46.4
1945	45.7	44.5
1946	40.6	41.2
	Aircraft Only	Engines & Parts
1947	39.7	39.9
1948	41.4	40.0
1949	40.5	40.7
1950	41.2	41.0

Source: CAA Statistical Handbook.

Table by Rudolf Modley

Average Weekly Earnings In the Aircraft Industry

Year	Aircraft & Parts excl. engines	Aircraft Engines
1914	$15.40	N.A.
1919	26.60	N.A.
1921	31.70	N.A.
1923	30.00	N.A.
1925	30.00	N.A.
1927	29.81	N.A.
1929	28.65	N.A.
1931	30.15	N.A.
1933	25.37	N.A.
1935	25.16	N.A.
1937	27.80	
1939	30.34	36.58
1941	37.75	47.04
1943	49.76	59.81
1945	54.27	57.93
	Aircraft Only	Engines & Parts
1947	53.99	56.30
1948	60.21	63.40
1949	62.60	65.25
1950	66.50*	69.00*

* Estimate.
Sources: Census of Manufactures.
Bureau of Labor Statistics.

Table by Rudolf Modley

in 1951 if delays in materials priorities machinery do not foul up schedules too seriously.

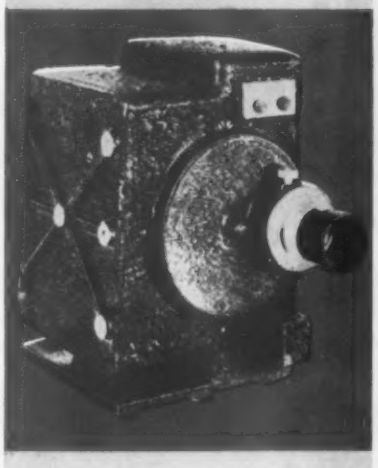
• **Personal.** Personal plane shipments were up slightly in numbers, and more appreciably in dollar volume. Plane shipments were about 3400 compared to 3362 and value was set at $19 million in 1950 compared to $14.3 million in 1949. Most of the lightplane companies are hard at work on military contracts.

Limited materials and manpower for continued business plane production, is expected to result in a sharp drop in 1951 despite the fact that there is more demand for the useful little business and farm planes now than there has been for years.

• **Helicopter.** Military sales increased sharply in 1950, and shipments will rise correspondingly in 1951 and 1952—but few civilian orders can be filled because of priority of military demands.

The sizeable gain, overall, in aircraft shipments in 1950 over 1949 widened profit margins so that the aggregate net profit of the industry prior to renegotia-

Synchronous
MOTION PICTURE CAMERAS



- *Synchronous Data Recording*
- *Flight Testing*
- *Missile Tracking*
- *Fire Control Evaluation*

MODEL IV 35 mm CAMERA

Model IV 35 mm Cameras, as shown above, are used in parallel gangs of two or more cameras to photograph events at separated locations with exact frame-for-frame synchronization. Features include coding and timing lights, a rotary frame counter, precisely located fiducial markers for locating the optical frame center, change gears for multiple frame speeds up to 20 f.p.s., single framing operation, and precise alignment of the mounting pads with the optical axis for interchangeability on mounts. Each camera contains a built in synchronization control which prevents any camera of a gang from gaining or losing a frame in any sequence throughout the length of the film.

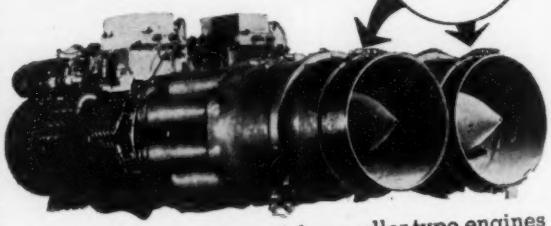
MODEL III 16 mm CAMERA

The Model III 16 mm Camera is available for applications where space is limited and requirements for determining positional information from the film frame are less severe. Model III and Model IV Cameras may be operated in parallel.

Inquiries regarding applications, prices and deliveries will receive prompt attention. Our Bulletin 4-A describing these cameras will be sent upon request.

FLIGHT RESEARCH ENGINEERING CORPORATION
P. O. Box I-F Richmond 1, Va.

V-Band Couplings Save Cost, Time on T-40 Turbo Prop Engine



One of the most powerful propeller type engines ever cleared for flight uses Marman V-Band Couplings to attach engine to tail cone with a rigid, high-strength connection. This standard unit is an ideal Coupling for all types of flanged joints. A large selection of types and sizes is available to accommodate a wide range of temperature, pressure and strength requirements.

ENGINEERS' NOTEBOOK

(Photo courtesy of General Electric Co.)

Coupling Simplifies Attachment of Jet Engine Tail Pipe

A Marman V-Band Coupling is used to join the tail pipe to the tail cone on the J-47 Engine. Fulfilling stringent requirements, it must maintain a tight seal at all times and provide a structural connection capable of carrying heavy loads under high temperatures. Quick connecting Marman V-Band Couplings achieve significant savings in space, weight, cost and time.

Save cost and design time With Marman Standard Clamps for Special Applications

FOR INFORMATION, WRITE: DEPT. M-2

MARMAN PRODUCTS CO. INC.

940 W. FLORENCE AVENUE
INGLEWOOD, CALIFORNIA

Personal Aircraft Shipments

Jan.-Dec. 1950

Manufacturer	Complete Aircraft	Net Billing Price (000)
Aeronca		
Champion 85 hp.	22	
Champion 90 hp.	81	
Superchief	8	$403
Sedan	51	
7FC	1	
7CCM[1]	8	
Beech		
Bonanza	458	
D-18	31	6,516
Bellanca		
Cruisair	5	
Cruisemaster	70	599
Cessna		
140A	318	
170A	637	5,506
190	58	
195	121	
Emigh-Trojan—Trojan	14	38
Engineering & Research		
G	21	69
Luscombe—8-F	22	61
Mooney—M-18	51	82
Piper		
Cub Special	3	
Vagabond	1	
Clipper	11	3,092
Tandem Trailer	454	
Pacer	566	
Stinson	73	
Ryan—Navion	250	2,618
Taylorcraft		
Sportsman	22	47
Texas Engineering		
Swift	22	96
T-35[1]	1	
TOTAL	3,386[2]	$19,157[2]

[1] Military type aircraft sold to other than U. S. Military customers. [2] Includes 6 Call-Airs valued at $30,000. The total is larger than the total for personal aircraft given in the table for 1950 aircraft production because it includes executive transports counted as "transports" by the Census Bureau.

Source: Personal Aircraft Council, Aircraft Industries Assn.

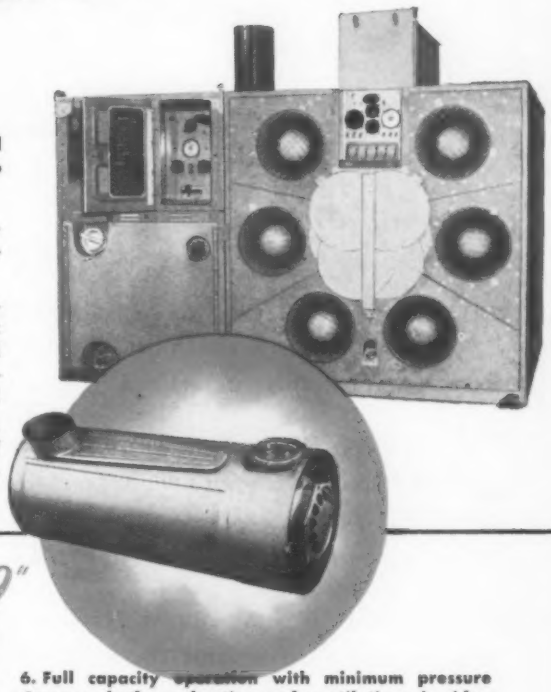
tion was considerably higher than in 1949. Accurate estimate of net income for 1950 for the industry is not yet possible, due to the amount of contract renegotiation and excess profits tax, still to be determined.

► **Investment Outlook**—A Jan. 25th aircraft industry analysis prepared by Standard & Poor's Corp. predicted that earnings of some aircraft concerns may decline temporarily in the first half of 1951 because of the time required for tooling up and filling supply pipelines, and because of the immediate effects of higher taxes, and the absence of special credits. Sales expansion by many aircraft companies nevertheless should still be sufficient to permit substantial earnings for some time beginning late in 1931.

The analysis pointed out that rapid technological changes and the industry's heavy dependence on military orders are uncertainties to be considered in aircraft investments. However, despite the fact that stocks of the aircraft group by the 1950 year-end had already reached the highest point since early 1946, it was recommended that "better-quality stocks such as Douglas, Grum-

4,000,000 btu/hr South Wind Equipped "A-1" Unit

..preheats America's sky giants!



This U.S.A.F. Type A-1 Unit teams up 6 South Wind "929s" to pre-heat engines, air foils, cabins, cargo hatches, landing gear, etc.—SIMULTANEOUSLY!

Actual performance has proved the ability of this new South Wind equipped "A-1" Unit to deliver over 4,000,000 BTU/hr!

Specifically designed to simplify and speed pre-heating of large aircraft, it forces heat through six main trunk ducts each of which can be separated into three smaller ducts. Result: you can *simultaneously* pre-heat up to 18 different parts of a large plane!

Selected as heat source for this U.S.A.F. Type A-1 Ground Heating Unit were 6 South Wind "929s" of 700,000 BTU/hr capacity each. And no wonder, for—

Only a South Wind "929"
combines all these advantages

1. Actually delivers rated output—performance on actual installations prove each "929" produces a full 700,000 BTU/hr.

2. Variable stage operation—gives full-range *control* of output from about 350,000 to 700,000 BTU/hr.

3. Easy service accessibility—spark plug, nozzle and fuel line assembly readily removable through access port on heater case. No need to remove heater from system for servicing.

4. Highly simplified design—adaptable for both "common source" and "separate source" air systems.

5. Case temperature switch—automatically controls metal temperature at optimum level during operation.

6. Full capacity operation with minimum pressure drops on both combustion and ventilating air sides.

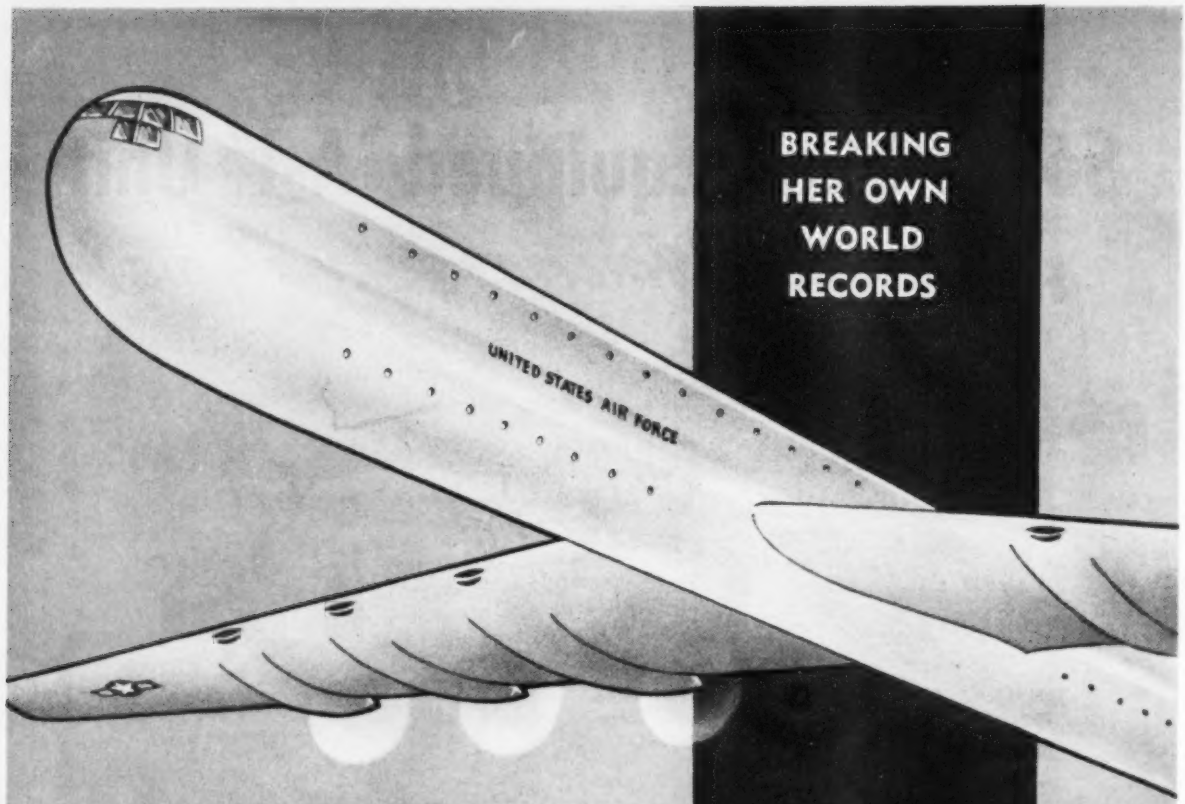
7. Operates on gasoline or jet fuels—the South Wind "929" is easily adaptable for any ground or air application: pre-heating, heating or thermal anti-icing.

Write today for full data on the "929" or any other model in the complete South Wind line of heaters for commercial, military or civilian aircraft. Models range in capacity from 20,000 to 700,000 BTU/hr. South Wind Division, Stewart-Warner Corporation, Indianapolis 7, Indiana.

South Wind

Another Product of STEWART WARNER

AIRCRAFT HEATING AND THERMAL ANTI-ICING EQUIPMENT



BREAKING HER OWN WORLD RECORDS

The Air Force's Convair-built XC-99 transport, with no more world cargo marks to break except her own, continues to set new records that no other aircraft can approach.

The conflict in Korea has proved conclusively that battles and even a major campaign can be lost if critical materials are not available immediately after an aggressor strikes.

Commitments by the United Nations to stop aggression throughout the world emphasize the desperate need for high-capacity, long-range air-cargo-carriers that can transport vast amounts of materiel where and when they are needed.

Only the C-99 can speed more than 100,000 pounds of weapons or supplies anywhere in the world in time to meet the initial thrust of an aggressor.

IN THE AIR — IT'S **CONVAIR**®

CONSOLIDATED VULTEE AIRCRAFT CORPORATION
SAN DIEGO, CALIFORNIA FORT WORTH, TEXAS

Appropriations & Expenditures

(Millions of Dollars)

Year or Fiscal Year	ARMY AIR CORPS.		NAVAL AVIATION		TOTAL	
	Appropr.	Expend.	Appropr.	Expend.	Appropr.	Expend.
1899	.05				.05	
1909	.03				.03	
1911	.03				.03	
1912	.1		.03		.13	
1913	.1		.01		.11	
1914	.2		.01		.21	
1915	.2		.01		.21	
1916	.8		1.0		1.8	
1917	18.7		3.8		22.5	
1918	735.0		61.5		796.5	
1919	952.3		220.4		1,172.7	
1920	28.1		25.7		53.8	
1921	35.1	30.9	20.0		56.0	
1922	25.6	23.1	19.1	13.9	44.7	37.0
1923	13.1	18.1	14.8	17.9	27.9	36.0
1924	12.6	11.0	14.7	17.0	27.3	28.0
1925	13.5	11.7	15.7	13.4	29.2	25.1
1926	15.9	14.9	18.2	15.9	34.1	30.8
1927	15.3	16.8	22.4	15.5	37.7	32.3
1928	21.1	19.4	20.3	22.4	41.4	41.8
1929	28.9	23.3	32.3	28.5	61.2	51.8
1930	34.9	28.1	31.5	28.7	66.4	56.8
1931	38.9	38.7	32.1	30.0	71.0	68.7
1932	31.9	33.0	31.2	31.6	63.1	64.6
1933	25.7	21.9	25.4	31.4	51.1	54.3
1934	31.0	17.4	29.7	16.2	60.7	33.6
1935	27.9	20.3	32.1	21.8	60.0	42.1
1936	45.6	32.0	40.7	23.0	86.3	55.0
1937	59.6	41.1	38.6	26.5	97.2	67.6
1938	58.9	50.9	51.5	60.8	110.4	111.7
1939	71.1	83.2	48.1	47.5	119.2	130.7
1940	186.6	108.2	111.5	49.5	298.1	157.7
1941	2,173.6	605.4	452.3	190.7	2,625.9	796.1
1942	23,049.9	2,554.9	6,189.4	1,062.5	29,239.3	3,617.4
1943	11,317.4	9,391.9	5,258.0	3,847.3	16,575.4	13,239.2
1944	23,656.0	13,087.3	4,583.7	4,490.1	28,239.7	17,577.4
1945	1,610.7	11,357.4	4,600.6	5,130.0	6,211.3	16,487.4

Table by Rudolf Modley

Wartime Dispersion of the Aircraft Industry

(By employment in airframe, engine, and propeller plants)

	West Coast	East Coast	West Central	East Central	Total Coast	Total Central
June 1940	45.9%	48.1%	2.3%	3.7%	94.0	6.0
June 1942	33.3	35.0	10.0	21.7	68.3	31.7
June 1943	26.2	31.3	14.6	27.9	57.5	42.5
June 1944	21.5	28.9	17.5	32.1	50.4	49.6

Source: War Plant Disposal—Aircraft Plants, Pt. 1, p. 45, Hearing U. S. Senate, Oct. 29, 1945.

Table by Rudolf Modley

Personal Aircraft Exports*

January-December, 1950

Country	Units	$ Value	Country	Units	$ Value
Argentina	10	$48,684	Israel	21	$45,255
Belgium	1	9,823	Madagascar	2	4,808
Brazil	160	658,732	Mexico	22	130,836
Canada	56	229,891	Morocco	2	12,580
Chile	25	146,094	Nicaragua	1	10,436
China	1	10,600	Netherlands	1	80,175
Colombia	12	70,087	Nigeria	1	4,496
Cuba	8	50,284	Panama	5	15,402
Ecuador	9	54,447	Paraguay	9	55,288
El Salvador	1	2,968	Portuguese Guiana	1	2,613
France	6	35,269	Sweden	1	2,500
Fiji Islands	1	4,496	Switzerland	11	81,802
Fr. Indochina	2	147,285	Tangier	3	19,057
Fr. Eq. Africa	1	3,286	Tahiti	1	1,810
Guatemala	12	53,865	Union of So. Africa	5	14,725
Indonesia	1	3,701	Uruguay	9	67,546
Iran	5	109,814	Venesuela	9	64,138
U. S. Territorial Shipments			**TOTAL EXPORTS**	415	$2,252,793
Alaska	26	$100,620			
Puerto Rico	3	9,888			
TOTAL	29	$110,508			

*** Civil aircraft of 5000 lb. and under empty airframe weight made by Aeronca, Beech, Bellanca, Cessna, Ercoupe, Luscombe, Piper, Ryan, Taylorcraft and Texas Engineering.**

Source: Aircraft Industries Assn.

man, Lockheed, North American and United Aircraft can be held. While more speculative, Consolidated Vultee, among others, appears fairly well situated."

The analysis foresaw a decline in profit for Boeing early in 1951 due to phase-out of the B-50 program and a higher tax rate, but materially expanded output and high level of profits is expected in the next few years. Despite the fact that Boeing holds the largest total dollar volume of military contracts in the 1951 fiscal year, the analysis considers its stock "only an average speculative prospect," because of present high prices of the stock.

Solar Aircraft, maker of jet engine afterburners and other engine parts, and Garrett Corp., (AiResearch) maker of cabin pressurization and air-conditioning equipment, were cited as outstanding equipment company investment possibilities.

Aircraft Costs

Average cost of Naval aircraft is $575,000, according to Deputy Chief of Naval Operations for Air, Vice Adm. J. H. Cassady.

Cost of Naval jet fighters ranges from $500,000 to $1 million. Cost of the P2V antisub patrol plane with a maximum amount of electronics, was set at $1.25 million.

Fly-away price of Air Force's Piasecki H-21 rescue helicopter, with a capacity for six litter patients and a rescue radius of 250 miles, is $200,829.

Engine Costs

Engine and overhaul costs for the Air Force are reported as follows:

R-3350 for the B-29. Original cost is $22,500. The cost of overhaul, made every 275 hours, is $3050.

J-47 for the B-47. Original cost, $38,500. The cost of overhaul, made every 150 hours, $7000.

J-47 for the B-36. Original cost, $38,500. The cost of overhaul, made every 55 hours, $7000.

R-4360-41 for B-36. Original cost, $55,425. The cost of overhaul, made every 250 hours, $6800.

Where indicated, the statistical tables in this section were prepared by Rudolf Modley, consultant of the Aircraft Industries Assn., and author of "Aviation Facts and Figures," McGraw-Hill Book Co., 1945. These tables may be used in conjunction with the similar tables in "Aviation Facts and Figures."

U. S. Reciprocating Engines

Manufacturer and Address	Model	No. of cylinders	Cylinder arrangement	Cooling system	Propeller drive	Power Ratings					Octane fuel	Bore and stroke (in.)	Displacement (cu. in.)	Compression ratio	B. M. E. P.	Blower ratio	Guaranteed fuel consumption @ cruising hp. (lb./hp./hr.)	Maximum oil consumption @ rated speed	Cylinder construction	Weights		Equipment			
						Takeoff hp. (S. L.)	At rpm.	Rated hp.	At rpm.	At altitude (ft.)										Gross weight dry without hub or starter	Pounds per hp. (installed)	Make spark plugs supplied with engine	Make ignition supplied with engine	Make starter supplied with engine	Make carburetors supplied with engine
Aircooled Motors, Inc. Syracuse 8, N. Y.	4A4-90-B3	4	Ho	A	D	....	....	90	2300	SL	80	4.5x3.5	225	7	138	.....	.50	.015	Ai	230[1]	2.56	Ch	Ei	Au	MS
	4A4-100-B3	4	Ho	A	D	....	....	100	2550	SL	80	4.5x3.5	225	7	138	.....	.50	.015	Ai	230	2.30	Ch	Ei	Au	MS
	6A4-150-B3	6	Ho	A	D	....	....	150	2600	SL	80	4.5x3.5	335	7	136	.....	.50	.015	Ai	321[1]	2.14	Ch	Ei	DR	MS
	6A4-165-B3	6	Ho	A	D	....	....	165	2600	SL	80	4.5x3.5	335	7	140	.....	.50	.015	Ai	324[1]	1.97	Ch	Sc	DR	MS
	6V4-178-B32[2]	6	Vo	A	D	....	....	178	3000	SL	80	4.5x3.5	335	7	140	.....	.52	.015	Ai	308[1]	1.73	Ch	Sc	DR	Be, MS
	6V4-165-B32F[2]	6	Vo	A[3]	D	....	....	165	3000	SL	80	4.5x3.5	335	7	138	.....	.55	.015	Ai	356[1]	2.16	Ch	Sc	DR	Be, MS
	6V4-200-C32[2]	6	Vo	A	D	....	....	200	3100	SL	91	4.5x3.5	335	8.5	152	.....	.52	.015	Ai	333	1.66	Au	Sc	DR	Be, MS
	6AG4-185-B12	6	Ho	A	G632:1	....	....	185	3100	SL	80	4.5x3.5	335	7.5	145	.....	.51	.015	Ai	369	1.80	Ch	Sc	DR	Be, MS
	6V6-245-B16F[2]	6	Vo	A[3]	D	....	....	245	3275	SL	80	4.7x4	425	7.5	140	.....	.52	.015	Ai	353	1.44	AC	Ei	....	Be
	6A8-215-B8F	6	Ho	A[3]	D	....	....	215	2500	SL	80	5x4.2	500	7	136	.....	.55	.015	Ai	487	2.26	Au	Ei, Sc	Au	MS
Continental Motors Corp. Muskegon, Mich.	A65-8	4	Ho	A	D	65	2300	65	2300	SL	73	3.875x3.625	171	6.3	131	.....	.49	.010	Al St	176	2.7	Au	Case	....	Be
	A65-12	4	Ho	A	D	65	2300	65	2300	SL	73	3.875x3.625	188	6.3	131	.....	.49	.010	Al St	184	2.8	Au	Ei	DR	Be
	C85-8	4	Ho	A	D	85	2575	85	2575	SL	73	4.062x3.625	188	6.3	139	.....	.51	.010	Al St	176	2.07	Au	Ei	....	Be
	C85-12	4	Ho	A	D	85	2575	85	2575	SL	73	4.062x3.625	188	6.3	139	.....	.51	.010	Al St	184	2.2	Au	Ei	DR	Be
	C90-8	4	Ho	A	D	90	2475	90	2475	SL	80/87	4.06x3.875	201	7	143	.....	.52	.010	Al St	184	2.07	Au	Ei	....	Be
	C90-12	4	Ho	A	D	90	2475	90	2475	SL	80/87	4.06x3.875	201	7	143	.....	.505	.010	Al St	188	2.06	Au	Ei	DR	Be
	C145-2	6	Ho	A	D	145	2700	145	2700	SL	80 87	4.06x3.875	471	7	141	.....	.505	.017	Al St	265	1.82	Ch	Sc	DR	M
	O470-11	6	Ho	A	D	190	2300	190	2300	SL	80/87	5x4	471	7	139	.....	.5	.020	Al St	399	2.1	BG	Sc	Ec	Be
	O470-7	6	Ho	A	D	205	2600	185	2300	SL	80/87	5x4	471	7	135	.....	.5	.020	Al St	344	1.86	BG	Sc	DR	Be
	E225	6	Ho	A	D	225	2650	225	2650	SL	80/87	5x4	471	7	143	.....	.5	.020	Al St	391	1.7	BG	Sc	Ec	Be
	W670-23	7	Rad	A	D	240	2200	240	2200	SL	80/87	5.125x4.625	667.8	7	129	.....	.52	.025	Al St	519	2.2	Ch	Sc	....	Be
Jacobs Aircraft Engine Co. Pottstown, Pa.	R-755-A	7	Rad	A	D	300	2200	300	2200	SL	80	5.25x5	757	6	135	.....	.440	.025	Al St	505	1.9	BG, Ch	Sc	Ec	Be
	R-755-E	7	Rad	A	G649:1	350	2500	350	2500	....	91	5.25x5	757	6.5	145	.....	.46	.025	Al St	600	1.9	Au, Ch	Sc	Ec	Be
Lycoming-Spencer division Avco Mfg. Corp. Williamsport, Pa.	O-145-B2	4	Ho	A	D	....	....	65	2550	SL	73	3.6x3.5	145	6.5	140	.....	.51	....	Ai	163.4	2.54	Ch	Sc	....	MS
	O-235-C1	4	Ho	A	D	....	....	108	2600	SL	80	4.3x3.8	233	6.75	141	.....	.52	....	Ai St	235[4]	2.26	Ch	Sc	DR	MS
	O-290-D	4	Ho	A	D	....	....	125	2600	SL	80	4.8x3.8	289	6.5	132	.....	.52	....	Ai St	258[4]	2.06	Ch	Sc	DR	MS
	O-435-A	6	Ho	A	D	....	....	190	2550	SL	80	4.8x3.8	434	6.5	136	.....	.52	....	Ai St	392[4]	2.32	Ch	Sc	DR	MS
	O-435-A2	6	Ho	A	D	....	....	225	3000	SL	91/98	4.8x3.8	434	7.5	137	.....	.51	....	Ai St	392[4]	1.93	Ch	Sc	DR	MS
	GO-435-A2	6	Ho	A	G77:120	....	....	240	3000	SL	91/98	4.8x3.8	434	7.3	146	.....	.47	....	Ai St	460[4]	1.91	Ch	Sc	DR	MS
	GO-435-C2	6	Ho	A	G77:120	....	....	240	3000	SL	91/98	4.8x3.8	434	7.3	146	.....	.47	....	Ai St	432	1.80	Ch	Sc	....	MS
	R-680-13	9	Rad	A	D	285	2300	280	2200	SL	91/98	4.625x4.5	680.4	7	150	1	.5	.025	Al St	585	....	Ch	Sc	....	Be
	GSO-580	8	Ho	A	G77:120	....	....	320	3000	SL	91/98	4.8x3.8	578	7.3	146	7.91	.5	....	Ai St	619	1.67	Au	Sc	....	Be
	GSO-580-B	8	Ho	A	G77:120	....	....	350	3000	SL	100/130	4.8x3.8	578	7.3	160	7.91	.5	....	Ai St	624	1.78	Au	Sc	....	Be

Manufacturer and Address	Model	No. of cylinders	Cylinder arrangement	Cooling system	Propeller drive	Power Ratings: Takeoff hp. (S. L.)	Power Ratings: At rpm.	Power Ratings: Rated hp.	Power Ratings: At rpm.	Power Ratings: At altitude (ft.)	Octane fuel	Bore and stroke (in.)	Displacement (cu. in.)	Compression ratio	B. M. E. P.	Blower ratio	Guaranteed fuel consumption @ cruising hp. (lb./hp./hr.)	Maximum oil consumption @ rated speed	Cylinder construction	Weights: Gross weight dry without hub or starter	Weights: Pounds per hp. (installed)	Equipment: Make spark plugs supplied with engine	Equipment: Make ignition supplied with engine	Equipment: Make starter supplied with engine	Equipment: Make carburetors supplied with engine
Pratt & Whitney division	Wasp Jr. B5[4]	9	Rad	A	D	450	2300	450	2300	2300	91/98	5.18x5.18	985	6	157	10	.....	....	Al St	682[7]	1.54	Op	Sc	....	Be
United Aircraft Corp.	Wasp S1H1[9]	9	Rad	A	D	600	2250	550	2200	8000	91/98	5.75x5.75	1344	6	148	12	.....	....	Al St	865[7]	1.57	Op	Sc	....	Be
E. Hartford 8, Conn.	Wasp S3H1-G[9]	9	Rad	A	G.667:1	....	....	550	2200	5000	91/98	5.75x5.75	1344	6	148	12	.....	....	Al St	865[7]	1.57	Op	Sc	....	Be
	Twin Wasp S1C3-G	14	Rad	A	G.5625:1	1200	2700	1050	2550	7500	91/98	5.5x5.5	1830	6.7	178	7.15	.....	....	Al St	1467[7]	1.4	Op	Sc	....	Be
	Twin Wasp D5	14	Rad	A	G2:1	1450	2700	1200	2550	6400	100/130	5.75x5.5	2004	6.5	187	7.15	.....	....	Al St	1575[7]	1.3	Op	Sc	....	Be
	Twin Wasp 2SD13-G	14	Rad	A	G2:1	1450	2700	1200	2550	5000	100/130	5.75x6.5	2004	6.5	187	7.15[10]	.....	....	Al St	1595[7]	1.3	Op	Sc	....	Be
	Twin Wasp E1	14	Rad	A	G.4375:1	1800	2800	1300	2600	8000	100/130	5.75x5.6	2180	6.7	182	7	.....	....	Al St	1870[7]	1.5	Op	Sc	....	Be
	Double Wasp CA3[11]	18	Rad	A	G.450:1	2400	2800	1800	2600	6000	100/130	5.75x5.6	2804	6.75	196	7.15	.....	....	Al St	2317[7]	1.3	Op	Sc	....	Be
	Double Wasp CA17[12]	18	Rad	A	G.450:1	....	....	1800	2600	6500	115/145	5.75x5.6	2804	6.75	196	7.29[13]	.....	....	Al St	2350[7]	1.3	Op	Sc	....	Be
	Double Wasp CB1	18	Rad	A	G.450:1	....	....	1900	2600	7000	115/145	5.75x6.6	2804	6.75	205	7.29	.....	....	Al St	2357[7]	1.3	Op	Sc	....	Be
	Double Wasp CB12[14]	18	Rad	A	G.4375:1	....	....	1800	2600	8500	100/130	5.75x5.6	2804	6.75	196	7.29[15]	.....	....	Al St	2390[7]	1.3	Op	Sc	....	Be
	Double Wasp CB16	18	Rad	A	.....	2435	2800	1800	2600	8500	100/130	5.75x6.6	2804	6.75	...	8.4	.....	.025	Al St	2390	....	Op	Sc	....	Be
	Wasp Major TSB3-G	28	Rad	A	G.357:1	3500	2700	2650	2550	5500	115/145	5.75x6.6	4363	7	188	6.375	.....	....	Al St	3482[7]	1.3	Op	Sc	....	Be
	Wasp Major B13	28	Rad	A	G.425:1	3500	2700	2650	2500	6000	115/145	5.75x5.6	4363	7	188	6.95[16]	.....	....	Al St	3520[7]	1.3	Op	Sc	....	Be
	Wasp Major CB2[23]	28	Rad	A	.....	3550	2700	2650	2550	5500	108/135	5.75x6.6	4363	....	...	.....	.....	.025	Al St	3670	....	Op	Sc	....	Be
Wright Aeronautical Corp.	C7BA1	7	Rad	A	G.5625:1	800	2600	700	2400	5000	91	6.125x6.312	1300	6.2	188	7.21	.76	.15	Al St	1065	1.3	Op	Bo	Op	Str
Wood-Ridge, N. J.	C9HD	9	Rad	A	G.666:1	1100	2500	1000	2300	6500	91	6.125x6.875	1520	6.3	125	10.14	.52	.02	Al St	1353	1.2	Op	Bo	Op	Str
	968C9HE1	9	Rad	A	G.5625:1	1475	2800	1275	2500	3500	100/130	6.125x6.875	1820	6.8	238	7.21	.45	.02	Al St	1390	.94	Op	Bo	Op	Str
	955C9HE1	9	Rad	A	G.4375:1	1525[17]	2800	1275	2500	10,600	100/130	6.125x6.875	1820	6.8	230	7.21[18]	.45	.02	Al St	1406	.93	Op	Bo	Op	Str
	749C18BD1	18	Rad	A	G.4375:1	2500	2800	2100	2400	4400	100/130	6.125x6.3125	3350	6.5	238	6.46[19]	.48	.015	Al St	2915	1.04	Op	Sc	Op	Str[20]
	956C18CA	18	Rad	A	G.4375:1	2700	2900	2300	2600	....	115/145	6.125x6.3125	3350	6.5	221	6.46[19]	.45	.02	Al St	2848	1.06	Op	Sc	Op	Str[21]
	C18CB	18	Rad	A	.....	2900[17]	....	....	....	....	.....	.....	....	....	...	.....	.....	....	Al St	.....	....	.....	.....	....	.....
	R-3350-30W[22]	18	Rad	A	.....	3250	2900	....	....	....	115/145	6.125x6.3125	3350	6.7	...	.....	.....	....	Al St	.....	....	.....	.....	....	Str[20]

A — Aircooled
Ai — Aluminum and cast iron
Ai St — Aluminum, cast iron and steel
Al St — Aluminum and steel
Au — Auto-Lite
Be — Bendix
Bo — Bosch
BG — BG Corp.
Ch — Champion
D — Direct drive
DR — Delco-Remy
Ec — Eclipse
El — Eisemann
G — Geared
Ho — Horizontally opposed
MS — Marvel Schebler

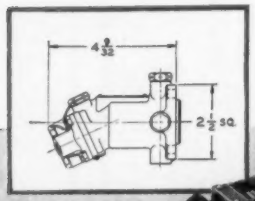
Op — Optional
Rad — Radial
Sc — Scintilla
Str — Stromberg
Vo — Vertically opposed

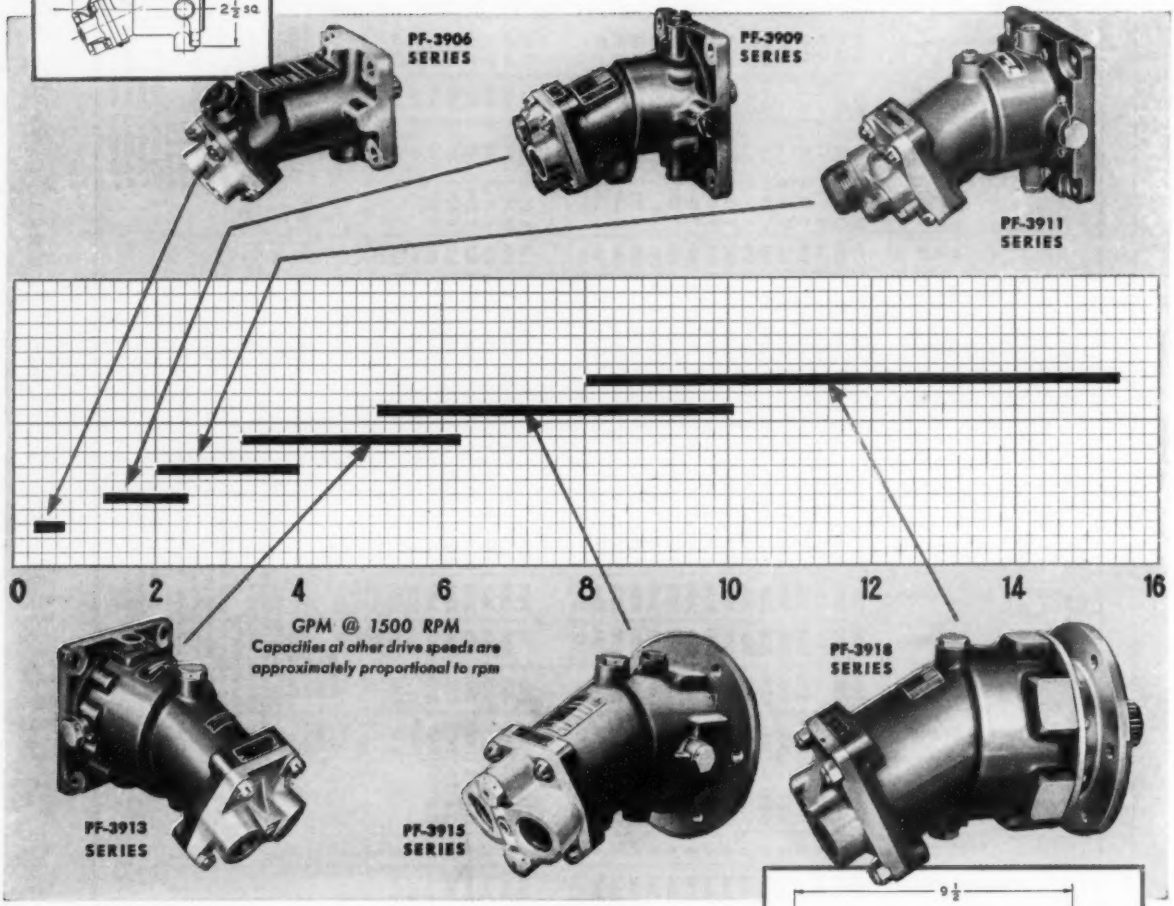
[1] Weight includes starter, generator, other parts and accessories.
[2] For helicopter installation.
[3] Cooling fan installed.
[4] Includes starter and other accessories.
[5] Wasp Jr. B4 has same performance but is designed for use with crankshaft in vertical position.
[6] Low impeller gear ratios. High ratios are: 9.52 for 2SD13-G; 9.10 for CA17.
[7] Includes starter and other accessories.
[8] S1H1-G has same performance but has .867 prop reduction gear and dry weight is 953 lb.
[9] Wasp S3H1 has same performance but has direct drive, weighs 865 lb. dry. S3H2 has same performance, dry weight, is direct drive and is designed to operate with crankshaft in vertical plane.
[10] Low impeller gear ratio, high is 9.52.
[11] CA5 has 200 hp. additional for takeoff.
[12] Similar engines are models CA15, CA18 and CA19.
[13] Low impeller gear ratio, high is 9.10.
[14] CB13 has 1900 normal rated hp. at 2600 rpm. at 7000 ft.
[15] Low impeller gear ratio, high is 9.10.
[16] High impeller ratio is shown.
[17] With water injection.
[18] And 8.69:1.
[19] And 8.67:1.
[20] Direct fuel injection.
[21] Impeller injection.
[22] R-4360-53 (fuel injection) fitted in B-36F has 3800hp. plus.
[23] Compound engine.

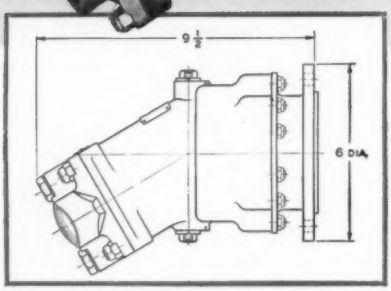
24 Sizes of efficient, reliable and compact

VICKERS PISTON TYPE PUMPS

CONSTANT DISPLACEMENT · 3000 PSI







Each of the 6 basic model series of Vickers Constant Displacement Piston Type Pumps shown here is available in four capacities (angles) for continuous duty at pressures up to 3000 psi. The capacity range of each series is shown at 1500 rpm; at other speeds the capacities are approximately proportional. Capacity overlapping between series provides a flexibility of application that often simplifies installation, stocking and servicing.

All these pumps have earned a remarkable reputation for reliability. Airline life in excess of 10,000 hours has been reported. Volumetric and overall efficiency are very high. Small size and extremely high horsepower to weight ratio are notable characteristics. Write for Bulletin 49-53 describing Vickers . . . the most complete line of hydraulic equipment for aircraft.

4324

VICKERS Incorporated
DIVISION OF THE SPERRY CORPORATION

1462 OAKMAN BLVD.
DETROIT 32, MICHIGAN

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

U.S. Gas Turbine Engines

Manufacturer and Address	Manufacturer's Designation	Military Designation	Type	Compressor stages	Turbine stages	Turbojets—Performance: Static thrust @ S.L. (lb.)	Turbojets—Performance: At rpm.	Turbojets—Performance: Rated thrust (lb.) S.L.	Turbojets—Performance: At rpm.	Turboprops—Performance: Shaft hp.	Turboprops—Performance: At rpm.	Turboprops—Performance: Equivalent shp. @ S.L.	Turboprops—Performance: At rpm.	Turboprops—Performance: Propeller reduction gear ratio	Fuel flow	Specific fuel consumption (lb./hr./lb. thrust or lb./hr./shp.)	Compressor air mass flow @ max. rpm. @ S.L. static, (lb./sec.)	Corresponding pressure ratio	Dimensions: Maximum length (in.)	Dimensions: Maximum dia. (in.)	Weights: Dry weight (lb.)	Weights: Accessories (lb.)	Weights: Total weight (lb.)	Equipment: Make starter supplied with engine	Equipment: Type starter supplied with engine	Overhaul Periods: Approving agency	Overhaul Periods: Time (hr.)	Overhaul Periods: Engine status	Planes Using
Allison division	400-D12	J33-A-33	CFJ	1	1	4600	11,750	3000	11,250	...	...	...	...	...	...	1.10†	89	4.4:1	213	49.31	1766	670‡	2465	GE	Elec.	USAF	500	IP	F-94A
General Motors Corp.	400-C13	J33-A-35	CFJ	1	1	4600§	11,750	3000	11,250	...	...	...	...	...	...	1.10†	89	4.4:1	107	59.5	1702	93‡	1795	GE	Elec.	USAF	500	IP	F-33, TO-2
Indianapolis, Ind.	400-D10	T38-A-21	AFP	11	1	5100	7800	4400	7500	...	...	1420	14,500	12:1	1.25	0.55	85	4.9:1	195.5	37	2127	708‡	2835	GE‡	Air	USAF	300	IP	F-89
	501-A4	T38-A-1	AFP	19	4	...	...	...	...	2765	14,500	...	...	...	...	.855*	...	...	146	45*	...	...	1540	AR	Air	...	...	X	Convair Turboliner
	500-A4	T40-A-4	AFP	19	4	...	...	...	...	...	...	...	...	...	...	.903*	...	...	145	45*	...	...	1575	AR	Air	...	...	IP	XA2D-1, XFV1-1
Fredric Flader, Inc.	124	J65-FF-1	AFJ	...	1	770	28,200	700	26,500	...	...	...	...	...	...	1.04	...	...	79	15.75	...	...	300	Br	...	...	...	X	...
583 Division St.																													
No. Tonawanda, N. Y.																													
General Electric Co.	TG-190-C	J47-GE-11*	AFJ	12	1	5200+	...	4320*	7370*	...	...	...	...	...	...	1*	93*	5:1*	144	36.75	...	...	2500*	GE	Elec.	...	...	IP	...
Aircraft Gas Turbine div.	TG-190-D	J47-GE-17	AFJ	12	1	5200+	...	...	...	...	...	...	...	...	...	...	...	...	225*	36.75	...	...	...	GE	Elec.	...	...	IP	...
920 West Main Ave.	TG-190-E	J47-GE-23	AFJ	12	1	5200+	7950	...	...	...	...	...	...	...	...	...	...	...	144	36.75	...	...	2500*	GE	Elec.	...	...	IP	...
Lynn, Mass.																													
Pratt & Whitney Aircraft div.	JT-4B	J42	CFJ	1	1	5750¶	...	4030	...	...	...	...	...	...	1.09	...	...	...	103.2	49.5	...	...	1723	...	...	USN	300	IP	P9F-2
United Aircraft Corp.	JT-7	J48	CFJ	1	1	6250¶	...	...	...	...	...	...	...	...	...	...	...	...	103.2	50	...	...	2000*	...	...	...	...	IP	F-94C, F9F-5
East Hartford, Conn.		J57	AFP	...	...	10,000*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	X	B-52
	PT-3	T34	AFP	13	3	3000	...	...	...	...	...	5700	...	11:1	...	.62	...	...	154	33	...	...	2550	...	...	...	...	OP	...
Westinghouse Electric Corp.	24C4B	J34-WE-23	AFJ	11	2	8000**	12,500	2200	...	...	...	...	...	...	...	...	...	...	120	24	...	...	1200	Weat.	Elec.	...	...	IP	XA3D-1, XF4D-1
Aviation Gas Turbine div.	40E	J40	AFJ	...	...	9000**	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	IP	XF10F-1, XF3H-1
Phila., Pa.	24C-10	J46	AFJ	...	...	6000*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	IP	...
Wright Aeronautical Corp.	Tyfoon	YJ65-W-1	AFJ	12	2	7220	...	...	...	1410	14,500	1570	14,500	...	...	.916	...	7:1	133.85	37.3	...	...	2500	...	...	...	...	IP	...
Division of Curtiss-Wright	Typhoon	...	AFP	10	2	...	...	...	...	2820	15,000	3140	15,000	10.37:1	...	.699	...	...	79.83	29	...	...	770	...	...	...	...	IP	...
Corp., Wood-Ridge, N. J.	Typhoon	...	AFP	10	2	...	...	...	...	2820	15,000	3140	15,000	10.37:1	...	.699	...	...	102	32.67	...	...	2000	...	...	...	...	IP	...
	Typhoon	...	AFP	14	2	...	...	...	...	4100	8000	4550	8000	7.4:1	...	.765	...	...	122.77	84.5	...	...	3485	...	...	...	...	X	...

Data in italics are Aviation Week estimates.
* — Approximate.
AFJ — axial-flow turbojet.
AFP — axial-flow turboprop.
CFJ — centrifugal-flow turbojet.
CFP — centrifugal-flow turboprop.
IP — in production.
X — experimental.
OP — out of production.
GE — General Electric.
AR — AiResearch.
Br — Breeze.

† 2.5 with afterburner.
‡ Includes components weights.
§ 6400 lb. with water/alcohol injection.
¶ Takeoff with water/alcohol: 32.5 1.5 gpm.
** Starter-generator.
†† Based on equivalent shp.
‡‡ Maximum width.
§§ Each engine.
¶¶ Also for -13, -18 and -19.
*** Using water/alcohol injection.
††† More than 8000 lb. with afterburner.
‡‡‡ 12,500 with afterburner.

LOW-COST PROTECTION for Airborne Electronic Equipment

New **LORD**

***TEMPROOF Mountings**

- **Exceed AN-E-19 Drop Test Requirements**
- **Designed for JAN-C-172A Equipment**
- **Maintain Efficiency from −80°F to +250°F**

*Temperature-proof

Here is reliable vibration protection for base-mounted airborne electronic equipment . . . and for other apparatus which must function properly above and below usual temperatures. And TEMPROOF Mountings are priced to meet the needs of manufacturers in competitive markets.

TEMPROOF Mountings provide superior protection by maintaining their high vibration-isolating efficiency from −80°F to +250°F. Selective-action friction dampers prevent excessive movement at resonant frequencies. Equipment does not sag or droop . . . mounting drift is negligible. The unusually wide load range of TEMPROOF Mountings makes it possible to standardize on one mounting for several types of equipment, and to effect additional economies in purchasing, storage and assembly.

For complete information on TEMPROOF Mountings, or for specific recommendations concerning their use, write to Product and Sales Engineering Department. A quantity of Vibration Isolation and Natural Frequency Charts in full color is available. Copy of each will be sent free upon request.

LORD MANUFACTURING COMPANY
ERIE, PENNSYLVANIA

LORD BONDED RUBBER

Vibration-Control Mountings . . . Bonded-Rubber Parts

Research and Development Budget Requests

One for the Money . . .

Original estimates for FY 1951:

AIR FORCE: $205,072,000
NAVY: $74,775,685

Two for the Show . . .

First supplemental for FY 1951:

AIR FORCE $241,072,000
NAVY: $93,262,000

Three to make Ready . . .

Second supplemental for FY 1951:

AIR FORCE: $369,298,538
NAVY $130,262,000

And Four to Go

Third supplemental for FY 1951:

Figures not available.

Money, Manpower and Machinery

These three tangibles govern quality and quantity of aeronautical research for tomorrow's combat craft.

The combat airplane of 1956 is being tested this year, in delicate miniature, in a wind tunnel at Langley Field. Its structure now lies under a microscope in Chicago and between the jaws of a testing machine in Bridgeport. Its engine is being proven in a six-inch pipe in Lynn and in a machine shop in San Diego. Its control system is maturing in an air-conditioned room on Long Island, in a new gyro in Los Angeles, and in the mind of a kid in your town.

When all the pieces have finally been put together, the craft will roar above a dry lake in the California desert. And it will flash upward at supersonic speeds to altitudes touched today only by a converted German vengeance weapon —of five years ago.

Between today and 1956 lie five years of intensive research and development in a hundred different places here and abroad. Millions of dollars and thousands of manhours will intervene between the paper design and the finished airplane. It hasn't always been that way, though.

► **Once, the Handbook**—There was a time—and not too long ago, either—when a lot of aeronautical engineering was handbook stuff. Subsonic airplanes were quite well understood, and their performance could be predicted without too much recourse to crystal balling. Surely, there were gaps in the knowledge; ailerons buzzed, or planes developed uncontrollable pitching moments. But by and large, aircraft design was not a very scientific procedure.

And then tiny, orange Glamorous Glennis—the Bell X-1—walked across the transonic bridge, and a new era of flight was born. With it was reborn the scientific approach which had been glossed over during the intensive development of the war years.

Today, research and development lead the conversation when engineers and scientists get together. Even their vocabulary has changed as new technologies have been absorbed into aeronautics. And everywhere, the lion's share of scientific effort is going into research and development.

And that is as it should be, because the problems facing aeronautical engineers today are tremendous, and there is little background and experience to aid in the solution of those problems.

► **Too Good?**—But there is a feeling among engineers in this business that maybe it's too good to last—maybe the tremendous research potential we are now building up will go by the board, should war come.

Engineers have expressed this view privately and in public meeting, but none has stated it with the conviction of Dr. Jerome C. Hunsaker in his letter of transmittal for the 36th annual report of the National Advisory Committee for Aeronautics:

"During World War II, the Committee curtailed its programs of basic research in order to concentrate on applying available scientific knowledge to the immediate improvement of aircraft scheduled for war production. This . . . was at the expense of the advancement of the scientific problems of flight. Although some adjustment is required in the event of emergencies, it must not occur again to the degree effected during World War II. To do so will undermine the research foundation upon which our future development program must be built."

Aside from the timeliness of Dr. Hunsaker's observation, his words spell the difference between research and development.

Research, he says, is the foundation upon which we build development.

It is well to reemphasize this relationship. There has been too much of a tendency to lump the two together.

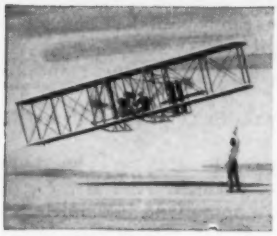
► **Fact-Finding**—Research can be defined as the process of determining facts in our special field of interest, aeronautical facts, or facts about things which make aeronautics better understood.

Development is the application of research. So, in one sense, it is a successor to research. But there are developments which come about without benefit of any previous research. So, in another sense, development is completely free of research.

To inventory research is impossible; in some cases, it lies only in the minds of scientists. To inventory development is nearly impossible. About the best we can do is to inventory the tools of research and development. And to do that, we almost have to lump the two together. In talking about research here, development will be included as well.

And this grouping is really fortuitous. Research is too pure to discuss in terms other than philosophical; development is so down-to-earth as to be completely uninspiring at times.

Both are made up of tangibles and intangibles.



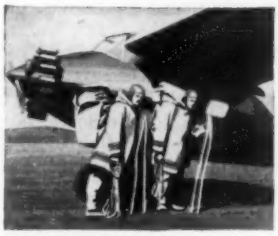
WRIGHT BROTHERS

ADMIRAL BYRD

LINDBERGH

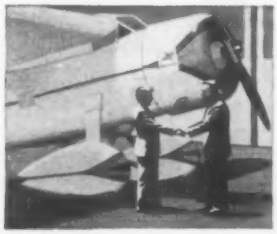
AMELIA EARHART

FIRST WITH THE FAMOUS



SIR HUBERT WILKINS

KINGSFORD SMITH



WILEY POST

JOE DE BONA

The Flying Red Horse Flew with them All

● List aviation's most famous names – the Flying Red Horse flew with them all! The reason is obvious . . .

The makers of Mobiloil supplied the first successful oil for the first successful airplane engine.

The makers of Mobiloil have played a leading role, since then, in developing products to meet progressively tougher operating conditions – higher engine power and heat, longer range, greater speed and altitude.

That's why, today, so many major airlines – so many famous pilots – use *Mobilgas Aircraft* for top performance . . . *Mobiloil Aero* for utmost dependability in flight!

Why accept anything less?

Mobilgas AIRCRAFT

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Why Accept Anything Less?

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The phenomenal growth and acceptance of the MICROCAST PROCESS within the short space of 22 years indicates only a bare surface-scratching to date of its potential development. Those small beginnings in the dental and surgical appliance field, hastened by wartime demands, paved the way for eventual industrial application.
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▶ **Three Are Tangible**—Behind the intangible research and development lie three tangibles:

• **Money,** to buy equipment and pay salaries.

• **Manpower,** to get ideas and do the work.

• **Machinery,** to test and build the evidence of research. And of these, no one is most important. Complete success depends on the proper proportioning of all three.

There are intangibles, too, that affect the quality and quantity of research.

One of these is time, because scheduling and deadlines are anathema to the average scientific worker. Another is imagination, because there are times when the ideas just don't come, and there are workers to whom ideas never come. Another is environment, because all scientists are not completely immune to the temperature of their building or the light intensity at their desks.

And in view of world affairs, another intangible—strain—is reflected in the work and output of engineers and scientists. There is feeling that something must be done and done quickly, even though it is well known that research thrives only in unworried minds. There are also the manhours spent unraveling the red tape of procedures and security.

These intangibles are hard to evaluate; you just can't say that test data at Langley Aeronautical Lab would be increased by X percent if the walls of the 4-ft. supersonic wind tunnel building were painted pale green instead of cream.

▶ **Evaluation Possible**—But tangibles are something else again; they can be totaled and evaluated. We can say that aeronautical progress in this country would profit by half-a-dozen more transonic wind tunnels and three more engine high-altitude test cells. And we can say that the expenditure of X-million dollars more this year would mean Y more men and Z more facilities and therefore, such-and-such a percentage increase in research data.

If we total these tangibles today, do they produce the right numbers? Do we have enough money, manpower and machinery?

Informed opinion varies. One agency says no; they would like to hire more men, and get a couple of their unfinished facilities completed.

Another agency says that they feel they are just about at strength with respect to manpower, equipment and budget.

A third says that lack of facilities is a real drawback to their productive efforts.

Who's right? They all are, because each sees research as a different thing entirely.

▶ **Men Are First**—Let's consider the manpower of research first. It's unfor-

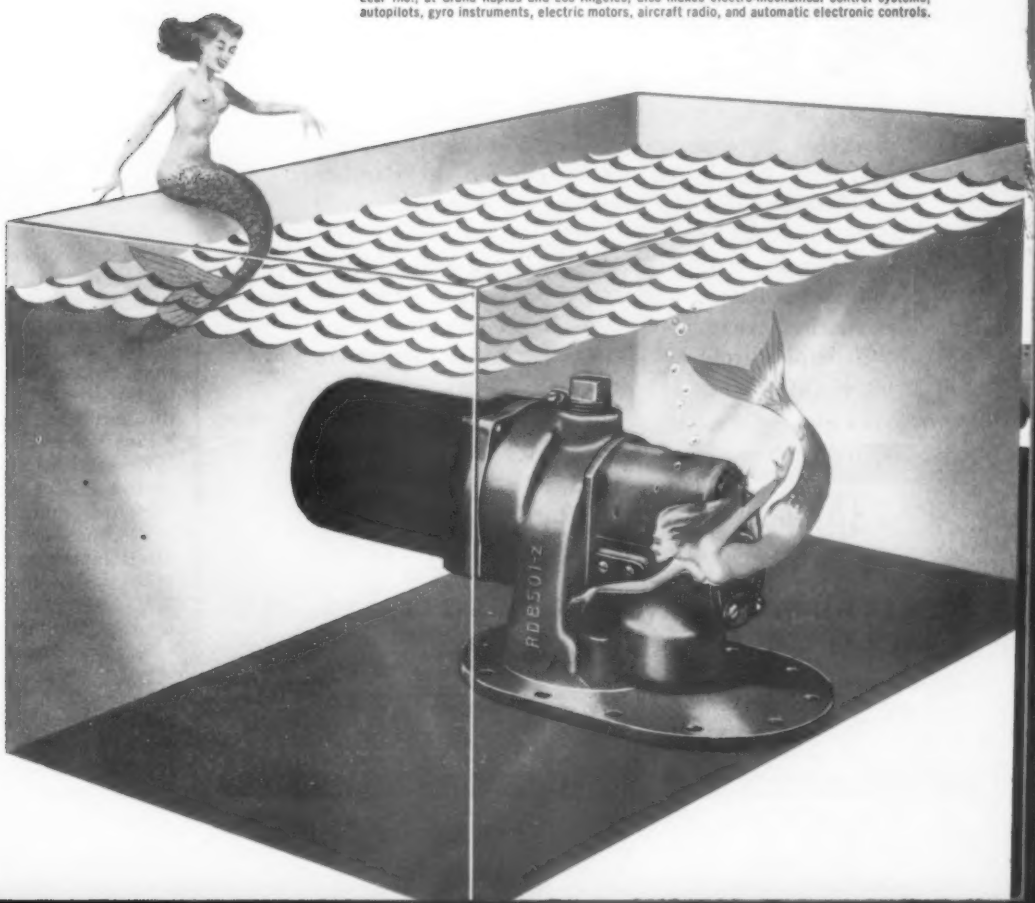
Simplify installation with the fully submerged LEAR-ROMEC water injection pump

To conserve precious space, aircraft designers immerse the Lear-Romec water injection pump within the confines of the anti-detonant reservoir itself, thus eliminating the need for an external mounting location. But a pump that will operate dependably under such unusual conditions requires unusual engineering. The completely sealed motors in the Lear-Romec fully submerged water injection pumps are vented to the atmosphere through an explosion-proof breather plug. Anti-friction materials are used throughout to permit harmless dry running in case the antidetonant fluid is exhausted before the pump is turned off. The hazard of galvanic corrosion is prevented by insulating the pump parts with non-conducting separations that prevent water from acting as an electrolyte. This thoroughly proved, fully submerged water injection pump—used on the Boeing 377 Stratocruiser, Consolidated CV240, Fairchild C-119, the Chase XC-123, the Boeing B-50, the Consolidated B-36D, and the North American AJ-1—is available in vertical as well as horizontal models. (Model RD-8500 illustrated below.) Specifications and test reports are available upon request.

LEAR ROMEC

A DIVISION OF LEAR INCORPORATED AT ELYRIA, OHIO

Lear Inc., at Grand Rapids and Los Angeles, also makes electro-mechanical control systems, autopilots, gyro instruments, electric motors, aircraft radio, and automatic electronic controls.



THE LIGHTWEIGHT ANSWER TO A HEAVY PROBLEM...

THE GLA IGNITION SYSTEM FOR THE Panther

On the Grumman F9F, ounces count; that's why you'll find the lightweight GLA *high energy condenser discharge system* doing a real heavyweight job! The Model ACD2-6 system for the Panther incorporates reliable performance from advanced electronic development with the latest weight and space saving design. Engineering and building this component for the Pratt & Whitney Nene jet engine is another example of GLA's leadership in solving the complex problems of electronic design involved in jet and supersonic aircraft.

An experienced technical staff with production facilities invites your inquiry. ***Write today.***

GENERAL LABORATORY ASSOCIATES INC.
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GLA
AIRCRAFT AND ELECTRONIC PRODUCTS

tunate that to many, the word research conjures up the picture of a white-jacketed doctor looking heavenward through a colored liquid in a retort. This PhD. thinking assumes that all worthwhile results in science are going to be accomplished by a highly-educated man with a doctorate in science or philosophy. And such thinking is wrong.

In any typical developmental organization, you'll find a complete cross-section of technical types. There will be men with higher education and long experience, who guide the overall technical policies of the group. There will be a couple of gladhanders who make the political contacts and have just enough technical background.

On working levels, there will be project organizers, scientists with or without doctorates, who have organizational and leadership talents. There will be pure research types, who work best alone and without supervision or responsibilty. There will be "horse" workers, plodding types who compute, or draw graphs and take data. And there will be mechanics who assemble and tear down apparatus and in general, keep things running.

▶ **Many Contributors**—Unfortunately, in some of these categories, the United States is facing technical bankruptcy.

An engineer or scientist graduating from college today finds himself in the middle of a sellers' market. He can have just about any job, anywhere. Chances are, he goes where the rate of pay is best.

And right now, that rate of pay seems best in tangible productive efforts—aircraft factories, for example. Men are desperately needed for making drawings, analyzing fittings, predicting performance—in general, applying the results of research and development.

And once these men have entered a specific engineering department, they are pretty much gone forever as far as basic research goes.

This means that manpower for theoretical investigations, for wind tunnel work, for applied mathematics is going to be diverted somewhere else. And this means less research.

▶ **Plus Value**—On the credit side of the ledger, and helping to balance the prospective loss of scientific personnel, are increased numbers of test facilities. Now almost any building with a piece of machinery under its roof can qualify as a research and development foundation. To catalog them would be exhausting, boring and incorrect.

But one measure of our prospective progress in aeronautical science is the number of our wind tunnels. And with military flight where it is now, perhaps the real clue is in tunnels of transonic capabilities or above, although certainly the low-speed tunnels are essential.

STOP FIRE

3 times more effective

than any other portable type fire extinguisher for

AIRCRAFT FIRE PROTECTION

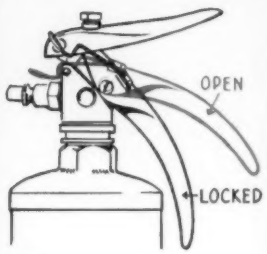
★AAF★
APPROVED
TYPE A-20
Available Sizes
1 Qt.-2½ Qt.-1 Gal.
PAT. NO. 2,530,583

with **PRESSURIZED CBM**
(CHLOROBROMOMETHANE)

Compact, Ready for Instant Use

1 Type A-20 (1 quart) occupies a 15" x 3⅜" x 4½" space, enclosed securely in a steel, rubber padded, positive locking bracket designed to meet highest military specifications. Weight with bracket—7½ lbs.

2 Just flip bracket clasp open, squeeze lower grip to break safety seal and A-20 comes out ready for action—all with one hand. Bracket vibration tested up to 500 c.p.s.



3 Exclusive, patented safety lock prevents accidental discharge, yet snaps into position for discharge with squeeze-grip pressure on lever.

4 Squeezing lever releases a powerful 30-foot stream of CBM in a split-second extinguishing action. One hand operation. No knobs or valves to turn.

CHLOROBROMOMETHANE

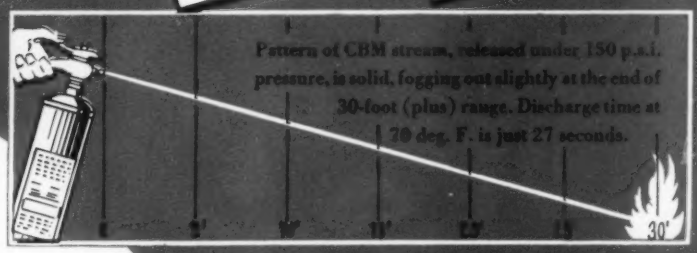
PRESSURIZED AT 150 p. s. i.

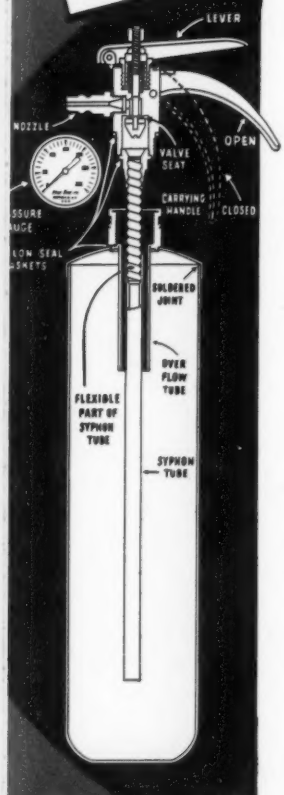
3 times more effective than carbon tetrachloride

Effective on Class A-B-C Fires

Operates from -65° to plus 160° F.

Discharge time 27 seconds at 70° F.


Pattern of CBM stream, released under 150 p.s.i. pressure, is solid, fogging out slightly at the end of 30-foot (plus) range. Discharge time at 70 deg. F. is just 27 seconds.
30'



REMOVABLE HEAD This feature allows for ready inspection, refilling, cleaning, or adjustment.

GAGE FOR QUICK CHECKING. The A-20 holds its pressure charge over long periods of time. Dial provides quick visual check on condition.

NON-CLOGGING NOZZLE fits all standard air chucks.

SAFETY SEAL. Soft copper wire and lead seal prevent tampering, yet break easily for instant operation.

TEFLON GASKETS. This material is highly resistant to extremes in temperature, corrosion and solvents, assuring a positive leakproof, lifetime seal.

SILVER-SOLDERED JOINTS. Clean, neat joints are designed to outlive the brass casing itself.

FLEXIBLE SYPHON TUBE. This assures maximum discharge of contents from any angle.

BURST PRESSURE 1200 P.S.I. Hydrostatic tests prove Type A-20 withstands pressures up to 1200 p.s.i. far in excess of specifications.

DRAWN BRASS SHELL. Exterior coated to resist solvents, humidity, sand, salt spray, dust and corrosion.

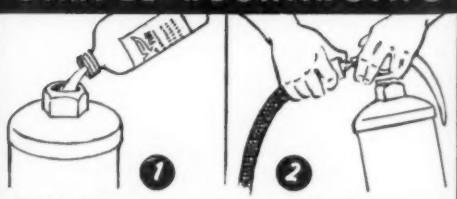
INQUIRIES INVITED

Our engineering department will be glad to analyze your fire hazard problems for aircraft, automotive or marine use.

WIDE RANGE AT MAXIMUM PRESSURE

Over 160 deg. of effective extinguishing action, from one standing position, is an invaluable feature for close fire fighting. A positive minimum of non-effective overhead range.

SIMPLE RECHARGING



(1) No tools necessary to recharge. Simply unscrew the removable head, fill reservoir with one quart of CBM, replace head. (2) Squeeze grip and fill with air to 150 p.s.i. from any standard air chuck and replace A-20 in bracket.

STOP FIRE INC.
125 ASHLAND PLACE
BROOKLYN 1, NEW YORK

PAT. NO. 2,530,583

U. S. High Speed Research Aircraft

Manufacturer	Designation	Powerplant	Thrust (lb.)	Span (ft.)	Length (ft.)	Height (ft.)	Gross weight (lb.)	Design speed (mph.)	Design altitude (ft.)
Bell Aircraft Corp.	X-1	1 RMI rocket Pressurized fuel system	6000	28.0	31.0	10.8	13,069	1000	60,000
	X-1A	1 RMI rocket Turbo-pump fuel system	6000	28.0	31.0	10.8	13,400	1700	80,000
	X-2[1]	1 RMI rocket	NA	NA	NA	NA	NA	2250	100,000
Douglas Aircraft Co.	X-3[2]	NA	NA	NA	NA	NA	NA	2599	200,000
Northrop Aircraft, Inc.	X-4	2 West J30	1600 each	25.0	20.0	15.0	7000	650	10,000
Bell Aircraft Corp.	X-5[3]	NA	NA	NA	NA	NA	NA	NA	NA
Douglas Aircraft Co.	D-558-I D-558-II	1 All J35 1 West J34 1 RMI rocket	5000 3000 6000	25.0 25.0	35.1 45.3	12.1 11.5	9750 16,000	650 1820	SL 75,000

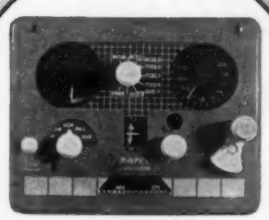
[1] Family resemblance to X-1; has sweptback wings, negative dihedral, stainless steel structure.
[2] Powerplant reported as combination of turbojet and rocket, later to be ramjet and rocket.
[3] Reported to have variable sweep-angle wings and to be similar to German DFS-228.
RMI—Reaction Motors, Inc.
West—Westinghouse Electric Corp.
All—Allison division, GMC.
NA—Not available.
SL—Sea level.

At this writing, almost forty transonic or supersonic tunnels of various sizes and capabilities exist in this country. Thirteen—perhaps more—are operated by NACA. Some of them are tiny things, intended primarily for instruction of students and very basic investigations. But each, in its own way, will contribute to our future airplanes.

Wind tunnels alone, of course, are not enough. The bits and pieces that make up the aerodynamic outlines must be tested and retested thoroughly. Take the airframe, for an example. Start with the basic equipment of a metallurgical laboratory, where the composition of new alloys would most likely be determined. The trail spreads out through dozens of other research facilities. From the lab it could lead to a single tension testing machine at NACA's Structures Research Lab or at Armour Research Institute. It might then lead back to the lab, or on to an aircraft factory where some sample structures are made and tested.

Eventually, it leads to a hangar where

THE narco Omnigator



Model VTR-1

NEW OMNIGATOR is VHF at its very best! With all 7 VHF units in one richly styled panel, it only weighs 18½ lbs. The complete system includes omni, two-way VHF radio, localizer, power supply & marker. INVESTIGATE AND FLIGHT TEST TODAY!

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WINGS FIELD, AMBLER, PA.

Airloc

THE PROVED FASTENER OF MANY USES

AIRLOC has proved the perfect fastener in any spot requiring the combination of tight closure and removable panel — cowlings, fairings, access doors, inspection plates, landing gear covers, etc. AIRLOC stays locked under extreme vibration, yet is readily released with screw driver, key or coin. Spring action compensates for variations in material thickness.

Monadnock, with a wealth of fastening experience, also welcomes inquiries from manufacturers seeking reliable development and production facilities.

MONADNOCK MILLS San Leandro California
subsidiary of UNITED-CARR FASTENER CORP.

Made to conform to United States Air Force Specification MIL-F-5591

Simple 3-piece construction . . . receptacle, stud and pin

★

3 sizes in a range of stud types and sizes for almost every need

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

These leading U. S. Air Force *PENETRATORS* are *POWERED* by Westinghouse

Being penetrators, these planes must carry out tactical missions deep into enemy territory. To provide the required fuel economy and dependability, Westinghouse J-34 turbojets have been chosen for their power plants.

Westinghouse is constantly striving for improvement in jet propulsion . . . to provide only the best for the United States armed forces it is privileged to serve. J-54002

Westinghouse

AVIATION GAS TURBINES

a complicated structure of holding fixtures, strongbacks and hydraulic jacks has been set up to apply simulated airloads to a complete airplane structure.

► **Expensive Engine**—The engine for the future airplane also is going to have a lot of developmental dollars charged to it. It could start in a metallurgical laboratory as a test specimen of a new heat-resistant alloy. But consider the finished article. The manufacturer tests it, the services test it, NACA tests it—on the ground, in flight and in altitude chambers or tunnels.

Today such test facilities are limited and overloaded. NACA's Lewis Lab in Cleveland can handle current production engines up to simulated altitudes of better than 50,000 ft. But there are engines nearing production which double today's mass flows and are aiming for altitudes above 70,000 ft. Where can they be tested?

One place will be the new Propulsion Sciences Laboratory which NACA is building at Cleveland. There, two new altitude chambers are to be activated before the end of this year, using the available air supply. By the end of next year, an augmented air supply should increase both mass flow and altitude possibilities, and make these new test cells of much greater value.

Another place will be the Arnold Engineering Development Division of the Air Force's Research and Development Command, at Tullahoma, Tennessee. By late 1952 (current target date) the high-altitude engine facility should be ready for operations. And its gigantic 16-ft. supersonic propulsion wind tunnel should be available by the beginning of 1954.

► **Navy Has Two**—Other possibilities include the Navy's Air Blast Facility at Pt. Mugu, or the test cells operated by Navy's BuOrd at Daingerfield, Texas. These latter two labs are better geared to ramjet work than to turbojet development, although there is a degree of interchangeability between the two types of engine test cells.

There is a gray shade in this picture, too, and that is the dates for completion of the facilities at Tullahoma. The high-altitude engine cells are ex-German equipment from the BMW (Bayerischen Motoren Werke) factories, which the Germans expected to have in operation during 1945. It will take us seven years to arrive at the same place, and that's seven years of lost time.

Time—and its corollary, experience—are things that money can't buy. Research funds for this year, no matter in what quantity, cannot replace the impounded dollars of recent memory. That money has been lost forever.

But the things that money can buy are the tools and men of research and development.

► **Half-Billion for Air**—And the amount of that money stands today at just short of a half-billion dollars for the Air Force and Navy research and development alone.

(Whenever Navy is mentioned from here on, reference is to naval air power, and not all naval research.)

Prospects for the next fiscal year, which begins July 1, 1951, are that this figure will be doubled. That's one billion dollars for research and development by the two largest spenders of aeronautical R&D money.

Tracking down these budget figures is difficult because of the many variables and methods of presenting money requests.

Fiscal year 1951, which began July 1, 1950, was entered with R&D budget estimates of about $205 million for the Air Force and $75 million for the Navy. Shortly after the fiscal year began, the Korean fuss also began, and it was felt that maybe the services could use some extra money.

A first supplemental increase in budget was submitted. In this, the Air Force did not ask for any increase in research funds. AF did say that there was about $120 million available to the Secretary of Defense for apportionment among the services, and that it could get along on whatever portion of that the AF was slated to get. (It got $36 million.) The Navy asked for an increase of about $28 million.

► **Second Request**—Some time later a second supplemental budget request was initiated, and in this one, the AF came through with an asking figure of $115-million increase. The Navy upped their estimates by another $37 million.

There is a third supplemental coming up, but details are not yet available on what the services will request. But it's a safe bet that they'll get it.

Final figures through the second supplemental increase were then $369 million for the Air Force and $130 million for the Navy.

There are two things to be noticed about this apparent three-to-one disparity in R&D funds. First, both revised estimates represent about a 75 percent increase over the original figures for FY 1951. Second, Navy and AF give entirely different breakdown and justification groups; direct dollar comparison is not possible on any easily determinable basis.

Even if they gave the same breakdowns, there would be no way of knowing just how much money is going to the services' research and development.

► **How It's Billed**—It works this way in the Air Force (and for Navy, read the similar branch of that service):

Research facilities are built and paid for out of Army Corps of Engineers money. So, improvements at Edwards

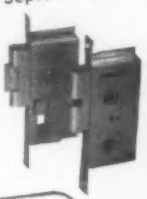
Need an assembly designed & built to your specs?

Adams-Rite has available the experience and the facilities to engineer and manufacture any type of small assembly to meet your requirements. This 50-year old company has accumulated its resources in the design of approximately 80% of all locks, latches and closure devices used on aircraft today, as well as specialized builders' hardware items and other equipment.

Send us your design specification or your drawing and the quantity required. You will receive our design proposal and quotation promptly.

Quadrant Assembly—Engine Control
First ordered January, 1949. Built to customer's design specification. Production delivery May, 1949. Now in quantity production.

Lock-Folding Door Latch-Folding Door
First ordered June, 1950. Built to customer's design specification. Production delivery September, 1950. Now in quantity production.



Bolting Mechanism—Door
One unit ordered. Designed and built to customer's specification. Delivery 35 days.

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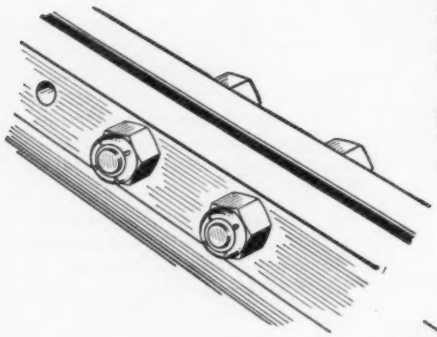
(ADVERTISEMENT)

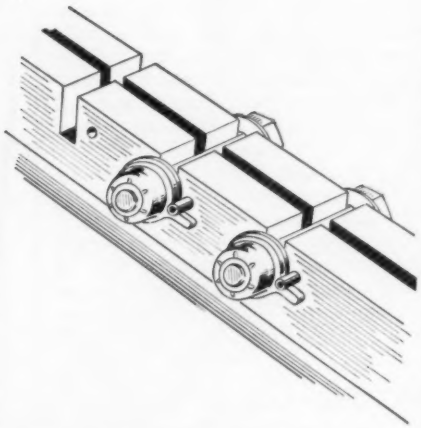
Fastener Problem of the Month

FEBRUARY, 1951



PROBLEM—To speed up and simplify assembly of jettisonable fuel tank sections. (Designed and manufactured by Republic Aviation Corp.)

Previous method called out drilled holes, bolts, and standard locknuts. Two men were required to hold and tighten nut and bolt assembly.



SOLUTION—ESNA special part 1616-048 and a Rollpin® used as a "stop".

Rollpins, ESNA's new self-locking fasteners, are driven into standard drilled holes and are permanently positioned without special machining, or extra locking operations. The special Elastic Stop Nut and two washers are pre-assembled on the bolt and tightened to a distance approximately 1/32" greater than the twin-flange thicknesses, and the unit is then dropped into a slot in the fuel tank flanges. When a power wrench is applied the Rollpin engages the nut lug and serves as a stop, permitting the bolt to be properly stressed. The famous Red Collar guarantees permanent tightness for the fuel tank assembly. Result, a one man method of assembly that eliminates expensive operations and saves time.

If you have an assembly problem where this ESNA special design might provide a solution . . . write to us and we will send you a standards drawing. Or if you have any other difficult fastener problems, please send us the details. More than 3000 standard ESNA parts and the services of experienced fastening engineers are ready to work out an efficient solution for you. Write to **Elastic Stop Nut Corporation of America, 2330 Vauxhall Road, Union, N. J.**

1616-048

Rollpin
3/32" Diam. x 7/16"

AFB or at the North American Aerophysics Lab would not show in the AF R&D column. In addition, some research on air ordnance is done by the Ordnance Dept. for the AF, and that money does not show in the AF figures. In like manner, chemical warfare or communications research would come under the doing agency's request and not figure in the AF estimate. And there are always a few dollars carried over from the previous fiscal year, plus transfer of funds from other branches of the services for work done by the AF for them.

How you can get a dollar value of R&D moneys is not too clear at the moment.

What you do get, after reading the hearings and interviewing a bit, is the impression that the services will get just about any amount they ask for and can justify. Congress, in large measure, is behind the increase in R&D funds.

These expenditures must be kept at a high level; they must also be kept free of wasteful duplication and useless investigation. The irreplaceable time we lost in the name of economy has narrowed the small lead we have in research and development.

With our future at stake, we must continue spending for intangibles today so that tomorrow we may have superior tangibles in aircraft and weapons.

Missile Research

Some of the most intensive research effort is in the guided missile area.

Army is concentrating on the Loki rocket in its research and development program. It will have a 60,000-ft. altitude range. For pinpoint operations, it won't supplant interceptor fighters for "area" air defense.

Navy's Bureau of Ordnance has earmarked $34 million for purchase of guided missiles.

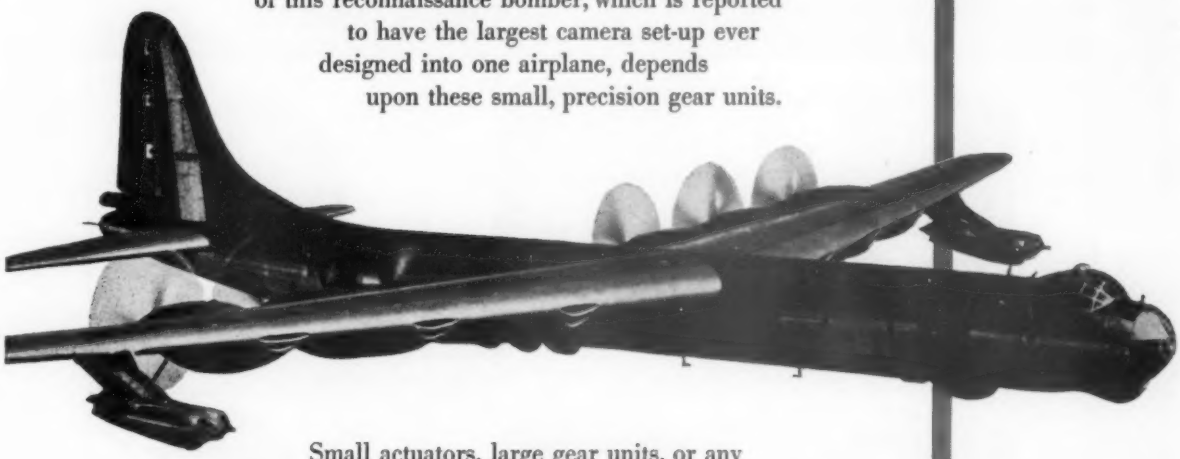
Marine Corps has earmarked $5,450,000 for the purchase of guided missiles. This is out of the $187 million already approved by Congress for weapons for the 1951 fiscal year.

Development of a guided missile with a sure aim is the only hope for guarantee against an atomic attack, Secretary for Air Thomas Finletter reported to Congress.

His outlook: "Until you get a guided missile which can go up and find an enemy bomber and knock it down and make a 100 percent kill, you are not going to stop more than a certain percentage of attacking planes. It does not make any difference whether you put radars over every square foot of the Atlantic and Pacific oceans and everywhere else, that is going to be true. . . ."

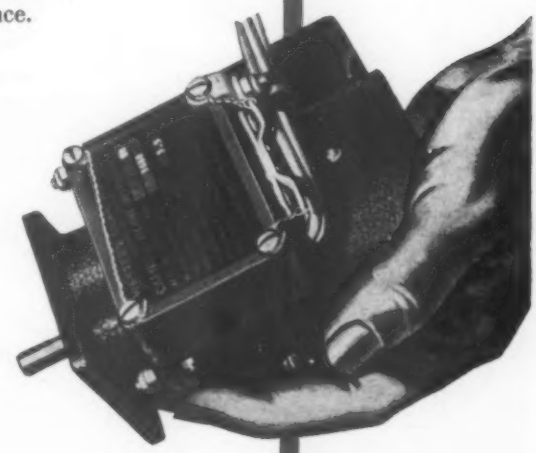
Western Gears "Open and Close Her Eyes"

Camera doors of the giant new Convair RB-36 are operated by nine Western Gear actuators, of the type shown here. Thus, the photographic effectiveness of this reconnaissance bomber, which is reported to have the largest camera set-up ever designed into one airplane, depends upon these small, precision gear units.



Small actuators, large gear units, or any type of geared product for ground or air-borne use — properly designed, manufactured, and tested — are available from Western Gear Works, backed by fifty years of gearmaking experience.

These camera-door actuators for the Convair RB-36 incorporate a triple-reduction spur-gear train with 96:1 ratio, provision for handcranking, torque-limiting clutch, and external adjustment of limit switches. Designed for operation in temperatures ranging from plus 160° F to minus 65° F.



For further information, or for copies of Actuator Bulletin 4811 or Aircraft Equipment Bulletin 4801, write Western Gear Works, P. O. Box 192, Lynwood, Los Angeles County, California.

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LEWIS Complete Temperature Measuring Systems for Aircraft

. . . Sturdy
. . . Accurate

Hermetically Sealed TEMPERATURE INDICATORS

TO "AN" AND AIR FORCE SPECIFICATIONS

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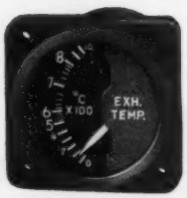
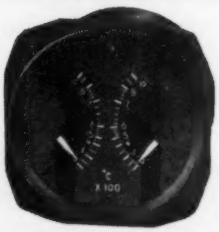
STANDARD RANGES FOR CYLINDER, BEARING OR EXHAUST TEMPERATURES



2" SINGLE INDICATORS
WITH MOUNTING BEZEL



2¼" DUAL INDICATORS

2" SINGLE INDICATORS
FOR RING CLAMP MOUNTING

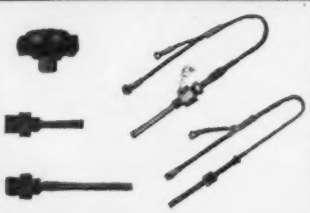
RESISTANCE THERMOMETERS
STANDARD RANGES FOR CYLINDER, OIL, FREE-AIR, COOLANT, CARB-AIR OR HEATING DUCT TEMPERATURES.

2" SINGLE INDICATORS
WITH MOUNTING BEZEL

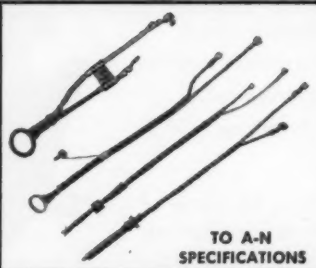
2¼" DUAL INDICATORS

2" SINGLE INDICATORS
FOR RING CLAMP MOUNTING

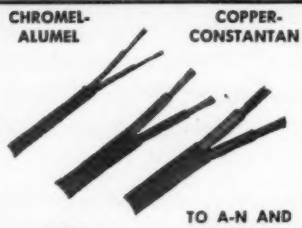
RESISTANCE BULBS • **THERMOCOUPLES** • **THERMOCOUPLE WIRE**
STURDY . . . FAST-ACTING — ACCURATE . . . RELIABLE — AIRCRAFT QUALITY . . . FROM OUR OWN WIRE MILL



A-N, FREE-AIR, STUFFING-GLAND
AND CYLINDER-HEAD BAYONET TYPES



TO A-N
SPECIFICATIONS



TO A-N AND
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SPECIFICATIONS

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THE LEWIS ENGINEERING CO.

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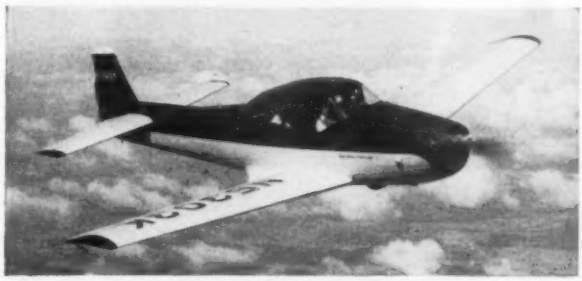

Ryan Navion Super 260

Cessna 170

Texas A&M Ag-1

Piper PA-20 Pacer 125

Piper PA-18 Super Cub 125

Aeronca Champion 7EC

A Good Sign to Fly to...

For 20 centuries, travelers have been reaching Paris by various roads and the River Seine. Today they often arrive via Orly Airport whose modern facilities offer service to planes from all over the globe. Aircraft owners and operators rely on Esso Aviation Products here at Orly just as elsewhere along the world's airways. These fine products are improved by constant research and development which meet and even anticipate the needs of modern aviation. The Esso winged oval symbolizes petroleum products of uniform, controlled quality backed by more than 42 years of aviation experience.

**At Orly Airport and throughout France the marketer of Esso Aviation Products is Standard Francaise des Petroles.*

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ESSO EXPORT CORPORATION, AVIATION DEPARTMENT
25 BROAD STREET, NEW YORK 4, N. Y.

U. S. Personal and Executive Aircraft

Manufacturer and Address	Designation	Number of seats	Powerplant: Number, make and hp. of each engine	Powerplant: Propeller number of blades make and diameter (in.)	Performance: Top speed (mph.)	Performance: Cruising speed (mph.)	Performance: Landing speed (mph.)	Performance: Takeoff distance over 50 ft. obstacle, no wind at gross weight (ft.)	Performance: Landing distance over 50 ft. obstacle, no wind at gross weight (ft.)	Performance: Initial rate of climb (fpm.)	Performance: Service ceiling (ft.)	Performance: Maximum range (mi.) fully loaded and without auxiliary tanks	Weights: Normal fuel capacity (gal.)	Weights: Gross weight (lb.)	Weights: Empty weight (lb.)	Weights: Cargo capacity (lb.)	Dimensions: Span	Dimensions: Length	Dimensions: Height	Dimensions: Wing area (sq. ft.)	Standard Equipment: Instruments[1]	Standard Equipment: Radio	Standard Equipment: Starter	Standard Equipment: Position lights	Standard Equipment: Landing lights	Price, F.A.F.
Aerocar, Inc. Longview, Washington	Aerocar I[2]	2	1 Lyc O-290-D @ 125	Se-74	110+	100	53	1225	.....	500+	12,000	300+	24	1800	912	60	30′	21′	7′ 2″	168	2AC; 3, 4, 5K, 13[3]	.....	DR	Gr	GL	$12,500
Aero Design & Engineering Corp. Box 118, Bethany, Okla.	Aero Commander 520	5–6	2 Lyc GO-435-C2 @ 260	H-88	200	197	58	1025	1000	1872	22,900	850	120	4800	2876	1103	43′ 10″	34′	12′ 10″	242	1; 3; 4; 5; 6; 7; 8; 9S; 11AP; 12GM; 13; 14; 15; 22; 23; 24; 25; 26; 27	Op	Ec	Gr	AD	$40,000*
Aero-Flight Aircraft Corp. Long Beach Municipal Airport, Long Beach, Calif.	Streak 165	2	1 Fr 6A4-165-B3 @ 165	2Se	219	210	57	429[4]	.....	2000	25,500	1060[4]	40	1695	1045	50	25′ 3″	22′ 4″	8′ 3″	.....	.....	.....	.....	.....	.....	.....
Aeronca Aircraft Corp. Middletown, Ohio	Champion 7EC	2	1 Con C-90-12F @ 90	2Se 72	110	100	44	906	1342	800	.....	351	....	1450	890	....	35′ 2″	21′ 8″	7′	.....	1AC; 3, 4USG; 17, 18, 19SW	Be	DR	Gr	Gr	.....
	Champion 7CCM	2	1 Con C-90-12 @ 90	2Se	110	100	42	850	1250	825	.....	.....	....	1300	809	....	35′ 2″	21′ 6″	7′	.....	1AC; 3, 4USG; 17, 18SW	.....	...	Gr	.....	.....
	Sedan 15AC	4	1 Con C-145 @ 145	2Se	129	114	53	1000	1600	800	.....	456	....	2050	1159	....	37′ 6″	25′ 3″	7′	.....	1AC; 3, 4USG; 17, 18, 19SW	.....	DR	Gr	GE	.....
Aircraft Manufacturing Co., Inc. Stewart Airport, Tyler, Tex.	Texas Bullet 205	4	1 Con E-185-1 @ 205	2H-78	.....	190	60*	1585	.....	955	17,450	750	....	2300	1350	....	28′	23.15′	.....	125	.....	.....	.....	.....	.....	.....
All American Aircraft, Inc. Long Beach 4, Calif.	Ensign 10A	2	1 Con C-85 @ 85	2M-72	125	100	55	850	500	750	10,000	400	20	1550	1000	40	33′	24′	8′ 6″	138	13SW; 16W	Ar	DR	Gr	.....	$3495
Anderson, Greenwood & Co. Route 3, Box 158 Houston, Tex.	AG-14	2	1 Con C-90-12F @ 90	2H-72	120+	110+	50	.....	.....	700+	19,000[5]	450	24	1400	850	250	34′ 6″	22′	7′ 6″	120	1AC; 3USG; 4K; 15, 17, 18, 19AC	.....	DR	Gr	GE	$4500*
Aquaflight Aircraft Corp. 1601 Harrison Ave. Wilmington 278, Del.	W-6-A Aqua 2	6	2 Lyc O-435-11 @ 225	2H-78	170	155	56	825	675	1200	20,000	480	100	4650	3200	....	36′ 6″	29′ 6″	12′	217.5	1; 3; 4; 5; 7; 8; 9; 10; 14; 15; 17; 18; 23; 24; 27; 28	Op	.....	.....	.....	$28,000*
Baumann Aircraft Corp. 12270 Montague St. Pacoima, Calif.	Brigadier B-290	5	2 Con C-145 @ 145	2Se	175	160	55	850	500	1250	18,000	750	75	3500	2150	100	40′	25′	9′	204	Full blind flight group	Op	DR	...	Gr	$25,000
Beech Aircraft Corp. Wichita, Kans.	Bonanza C35	4	1 Con E-185-11 @ 205	2B-88	190	175	55	1065	720	1100	18,000	860	39	2700	1625	270	32′ 10″	25′ 2″	6′ 6.5″	177.6	1AC; 3; 4K; 7Sch; 8E; 9K; 13B; 14K; 21B	L	Ec	Gr	GE	$12,990
Cessna Aircraft Co. Wichita, Kans.	170	4	1 Con C-145-2 @ 145	2Se-73	140+	120+	55.9	1820	1755	690	15,500	450+	42	2200	1200	120	36′	25′	6′ 7.5″	174	1; 3; 4; 5; 15; 17; 18; 19; 21	.....	.....	...	.....	.....
	190	4–5	1 Con W-670-23 @ 240	2HS-93	170+	160+	62.5	1670	1495	1050	16,000	700+	....	3350	2015	200	36′ 2″	27′ 1″	7′ 2″	218.1	1; 3; 4; 5; 7; 8; 9; 11; 14; 15;	.....	.....	...	.....	.....
	195	4–5	1 Jac R-755-A2 @ 300	2He-93	180+	165+	62.5	1500	1495	1200	18,300	700+	....	3350	2030	200	36′ 2″	27′ 3″	7′ 2″	218.1	17; 18; 19; 20; 24	.....	.....	...	.....	.....
																					Same as 190	.....	.....	...	.....	.....
Continental, Inc. Danbury, Conn.	Airphibian[6]	2	1 Fr @ 150	3Se-73	120	110	55	.....	.....	585*	11,050*	400+	30	2100	1520	....	34′	22′ 2″	17′ 7.5″	.....	1AC; 3; 4K; 7Sch; 13AC	Op	....	...	.....	.....
Funk Aircraft Co. Coffeyville, Kans.	B85C	2	1 Con C-85 or C-90 @ 85	2Le-72	115	105	40	400	400	800	.....	400	....	1350	890	....	35′	20′ 1″	6′ 1″	.....	.....	.....	DR	Gr	.....	$3900*
Goodyear Aircraft Corp. Akron 15, Ohio	GA-22	4	1 Con E-185 @ 205	2H-84	133	119	55	1385	1000	700	13,250	350	34	2875	1875	607[7]	38′	29.7′	10.17′	209	1W; 3, 4K; 5AP; 7Sch; 8, 9, 14K, 21SF	GE	Ec	Gr	GE	.....
T. P. Hall Engring Corp. 410 Spreckles Bldg. San Diego 1, Calif.	118 Flying Auto	4	1 Lyc O-435-A @ 190	78	133	128	61	675[8]	675[8]	645	11,500	400	....	2500	1484	120	34′ 6″	23′ 3″	8′	158	.....	.....	.....	.....	.....	.....
Lanier Aircraft Corp. Marlton-Medford Airport Marlton, N. J.	Paraplane 120	2	1 Con C-90	.....	126	110	30	300	.....	1200	.....	.....	20	1325	870	....	20′ 5″	22′	6′ 4″	110	.....	.....	.....	.....	.....	.....

Manufacturer & Address	Designation	Number of seats	Powerplant: Number, make & hp. of each engine	Powerplant: Propeller number of blades make and diameter (in.)	Performance: Top speed (mph.)	Performance: Cruising speed (mph.)	Performance: Landing speed (mph.)	Performance: Takeoff distance over 50 ft. obstacle, no wind at gross weight (ft.)	Performance: Landing distance over 50 ft. obstacle, no wind at gross weight (ft.)	Performance: Initial rate of climb (fpm.)	Performance: Service ceiling (ft.)	Performance: Maximum range (mi.) fully loaded and without auxiliary tanks	Normal fuel capacity (gal.)	Weights: Gross weight (lb.)	Weights: Empty weight (lb.)	Weights: Cargo capacity (lb.)	Dimensions: Span	Dimensions: Length	Dimensions: Height	Dimensions: Wing area (sq. ft.)	Standard Equipment: Instruments[1]	Standard Equipment: Radio	Standard Equipment: Starter	Standard Equipment: Position lights	Standard Equipment: ding lights	Price, F.A.F.
Meyers Aircraft Co. Box 721, Tecumseh, Mich.	145	2	1 Con C-145-2 @ 145	2M-74	166	150	42	.....	.....	962	18,000	600	32	1910	1275	50	30′	21′ 10″	6′	154	2; 3; 4; 5; 10; 14; 15; 17; 18; 19	.....	DR	Gr	GE	$6995
Mooney Aircraft, Inc. Airport Box 3012 Wichita, Kans.	M-18C Mite	1	1 Con A-65 @ 65	Fl-65	142	130	43	700	680	1090	19,000	390	12	850	540	75	26′ 10″	17′ 8″	6′ 3.25″	95	1SW; 3AM; 4USG; 5K; 17, 18SW	Op	DR	Gr	Gr	$2325
Morrisey Aircraft Co. P. O. Box 829 Long Beach, Calif.	Nifty 1000C	2	1 Con C-90-12F @ 95	2Se-72	122	110	40	280	310	850	20,000	325	15.5	1350	830	25	20′	20′	7′ 2″	134	1; 3; 4; 5; 13	.....	.....	Gr	.....	$2900
Personal Aircraft Research Center Texas A&M College System College Station, Tex.	Ag-1	1	1 Con E-225-104-14X @ 225	2M, Ko-90	115	100	45	1300	.....	600	12,000	400	48	3400	1900	[9]	39′	29.7′	8.6′	286	.....	.....	.....	.....	.....	.....
Piper Aircraft Corp. Lock Haven, Pa.	PA-18 Super Cub 95	2	1 Con C-90 @ 90	2Se-74	110	100	42	952	800	624	13,500	360	18	1500	800	220	35.3′	22.33′	6.7′	178.5	1SW; 3AM; 5AP; 4AM; 17, 18SW	.....	.....	.....	.....	$3295
	PA-18 Super Cub 125	2	1 Ly O-290-D @ 125	2Se-74	123	108	38	580	600	870	21,100	250	18	1500	845	220	35.3′	22.33′	6.7′	178.5	1SW; 3, 4AM; 5AP; 17, 18SW	.....	.....	.....	.....	$3695
	PA-20 Pacer 125	4	1 Ly O-290-D @ 125	2Se-74	135	125	48	1788	1187	810	15,500	580	36	1800	970	400	29.3′	20.4′	6′ 2.5″	147.5	1SW; 3, 4AM; 5AP; 14, 17, 18USG	.....	DR	.....	.....	$4295[10]
	PA-20 Pacer 135	4	1 Ly O-290-D @ 125	2Se-74	135	134	48	1788	1187	850	15,500	580	36	1800	1000	400	29.3′	20.4′	6′ 2.5″	147.5	1SW; 3, 4AM; 5AP; 14, 17, 18USG	.....	DR	.....	.....	$4780[11]
	PA-22 TriPacer 125	4	1 Ly O-290-D @ 125	2Se-74	133	123	48	1788	1187	810	15,500	580	36	1800	1000	400	29.3′	20.4′	6′ 2.5″	147.5	1SW; 3, 4AM; 5AP; 17, 18USG	.....	DR	.....	.....	$4565[12]
Rawdon Bros. Aircraft, Inc. Wichita 1, Kans.	T-1	2	1 Ly O-290-C & -3 @ 125	2M-76	138	120	50	700	600	785	17,700	500	30	1800	1225	40	33′ 4″	24′ 2″	7′ 3″	165	1J; 3, 4, 7, 9P or K; USG	.....	Ec	Gr	.....	$6175
Ryan Aeronautical Co. Lindbergh Field San Diego 12, Calif.	Navion-B Super Navion 260	4	1 Ly GO-435-C2 @ 260	2H-93	174	170	55	770	875	1250	18,000	505	39.5	2850	1930	....	33′ 4.5″	27′ 6″	8′ 7″	185	2AC; 3USG; 4K; 5AP; 7Sch; 8E; 9; 10SW; 14USG; 15KS; 17, 18, 19SW; 24L; 27Sc	RCA	Ec	Gr	Ry, GE	$14,485
Taylorcraft Inc. Conway, Pa.	Special DeLuxe	2	1 Con C-65 @ 65	72	105	95	38[13]	.....	.....	600	.....	.....	....	1200	750	....	36′	21′	6′ 6″	.....	.....	.....	.....	.....	.....	.....
	Turist	4	1 Con C-145 @ 145	.....	125	115	36[13]	.....	.....	700	.....	.....	....	2200	1220	....	36′ 4″	24′	7′ 1″	.....	.....	.....	.....	Gr	.....	.....
	Sportsman	2	1 Con C-85-12 @ 85	72	120	110	38	.....	.....	700	.....	.....	....	1280	850	....	36′	22′	6′ 6″	.....	.....	.....	DR	Gr	.....	.....
Texas Engrg. & Mfg. Co., Inc. P. O. Box 6191 Dallas 2, Tex.	GC-1B Swift	2	1 Con C-125 @ 125	2Se, K-72	150	140	48[13]	685	380	1000	16,000	425	27	1710	1185	....	29′ 4″	20′ 10.75″	6′ 2″	131.6	.....	.....	.....	.....	.....	.....
	SF DeLuxe Silvaire	2	1 Con C-90 @ 90	2Le, Se, M-71	120	100+	40[13]	700	500	850	17,000	550+	25	1400	890	....	35′	22′ 6″	5′ 10.5″	140	.....	.....	.....	.....	.....	.....
Wittman Flying Service Winnebago County Airport Oshkosh, Wis.	DFA	1	1 Con C-85 @ 85	2Wi-60	215	175	65	.....	.....	1800	20,000	500	15	830	520	30	16′	17′ 6″	4′ 8″	66.5	.....	.....	.....	.....	.....	.....
	W	2	1 Con C-85 @ 85	2Wi-68	147	135	40	.....	.....	875	18,000	540	20	1250	670	60	26′	21′	5′ 8″	110	.....	.....	.....	.....	.....	.....
	WD	4	1 Fr @ 150	2M-72	165	145	48	.....	.....	750	16,000	600	37	2200	1178	120	29′	22′ 3″	6′ 6″	162.5	.....	.....	.....	.....	.....	.....

* — Approximate.
AP — Airpath.
AA — Air Associates.
AC — AC Spark Plug.
AD — Aero Design & Engineering.
AM — Aeromarine.
B — Beech.
Be — Bendix.
Con — Continental.
DR — Delco-Remy.
E — Elgin.
Ec — Eclipse.
F — Fahlin.
Fl — Flottorp.
Fr — Franklin.
GE — General Electric.
GL — Guide Lite.
GM — General Motors.
Gr — Grimes.
H — Hartzell.
HS — Hamilton Standard.
J — Jaeger.
Jac — Jacobs.
K — Kollsman.
Ko — Koppers.
KS — King-Seeley.
L — Lear.
Le — Lewis.
M — McCauley.
P — Pioneer.
RCA — Radio Corp. of America.
Ry — Ryan.
S — Sperry.
Se — Sensenich.
Sc — Scott.
Sch — Schwien.
SF — Safe Flight.
SW — Stewart-Warner.
USG — U. S. Gauge.
W — Watson.
We — Weston.
Wi — Wittman.

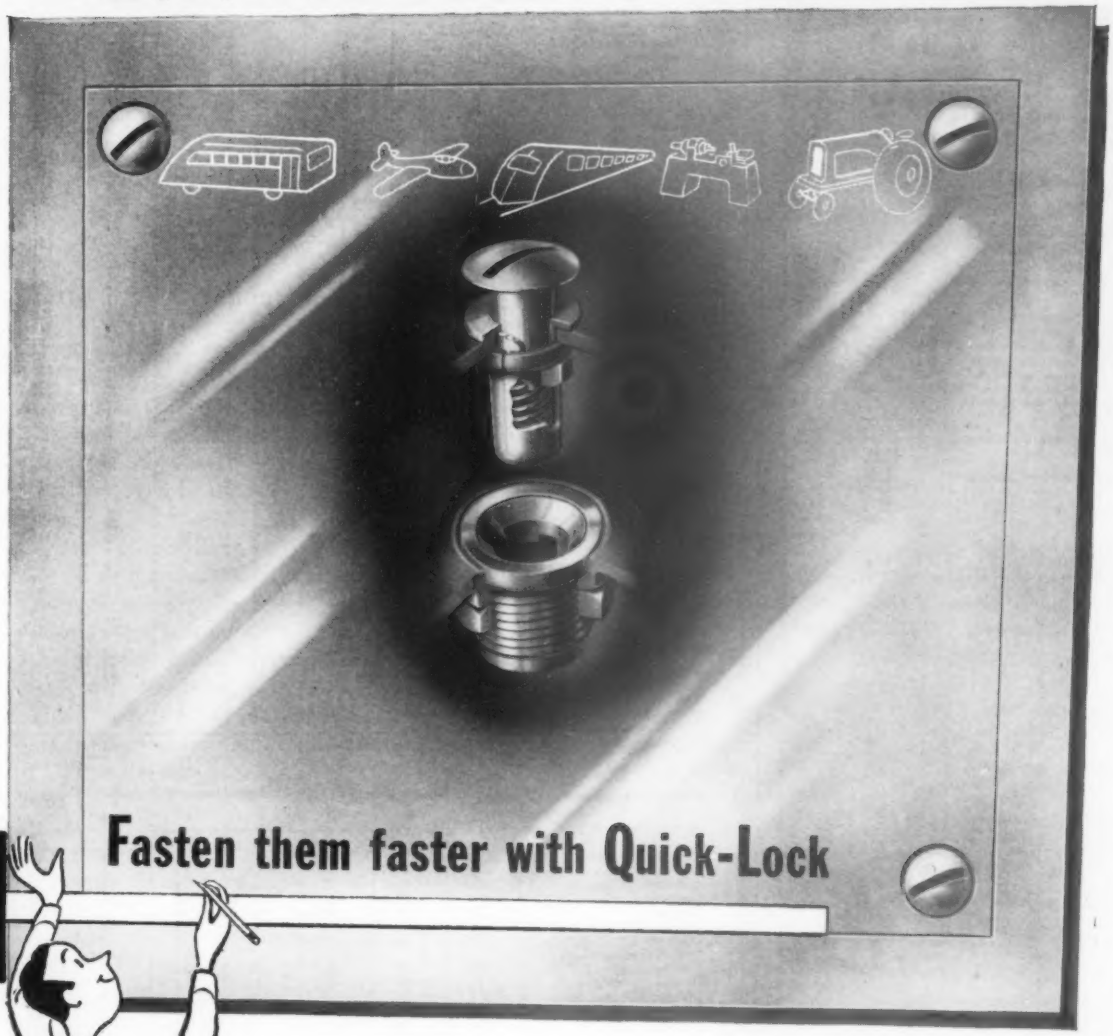
Instrument Code

1—tachometer, 2—tachometer with engine-hours meter, 3—airspeed, 4—altimeter, 5—compass, 6—hydraulic pressure gage, 7—bank-and-turn, 8—clock, 9—rate of climb, 10—fuel pressure, 11—flap position, 12—cylinder head temperature, 13—engine group, 14—manifold pressure, 15—fuel quantity, 16—flight group, 17—oil pressure, 18—oil temperature, 19—ammeter, 20—carburetor air temperature, 21—stall warning indicator, 22—attitude gyro, 23—directional gyro, 24—cylinder head temperature thermocouple, 25—lead thermocouple, 26—bulb thermometer, 27—outside air temperature, 28—artificial horizon.

[1] Numerals indicate type of instrument (see Instrument code); letters indicate maker—see preceding columns.

[2] Flying automobile.
[3] Stewart-Warner speedometer with engine group.
[4] Maximum range.
[5] Absolute ceiling.
[6] Flying automobile. First to be CAA-approved.
[7] With only a pilot.
[8] Conditions not given.
[9] Dust hopper (27 cu. ft.) or 150-gal. spray tanks.
[10] Standard model. Deluxe is $4385.35; Custom is $4885.75.
[11] Standard model. Deluxe is $4861.35; Custom is $5225.39.
[12] Standard model. Deluxe is $4655; Custom is $5097.
[13] Stalling speed.

Simplify Your Access Panel and Door Assemblies...



Fastening removable access doors and panels need not be a laborious and costly production or assembly operation—not if they're fastened with QUICK-LOCK.

Designed for simple installation, QUICK-LOCK requires no special tools. It speeds up mounting and demounting detachable panels with only a 90° turn required to lock and unlock it *in a jiffy*.

The flexible mounting and tapered stud makes QUICK-LOCK ideal for assembling curved sheets and insures a tight fit when locked. Stud is self-ejecting when unlocked. Minimum deflection is assured—only initial loads are carried by the helical spring. Solid supports take up increased loads.

Industrial and agricultural equipment manufacturers would do well to analyze the cost-saving features of QUICK-LOCK's simple design. A good way would be to call in a Simmons Engineer and discuss the economy of a QUICK-LOCK installation as compared to your present fastening method. Why not send for him today?

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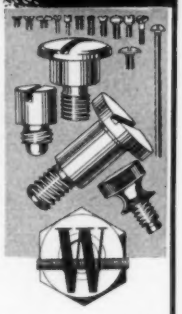

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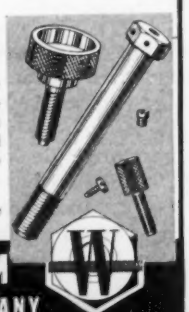

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Airports by Type and Class

State	Municipal	Commercial	CAA Intermediate	Military	Mse. Govt.	Private	TOTAL
Alabama	35	25	0	16	4	7	87
Arizona	48	32	1	22	27	48	178
Arkansas	32	34	0	0	0	20	86
California	162	169	6	43	9	141	530
Colorado	55	30	2	3		17	107
Connecticut	9	18	0	0		5	32
Delaware	2	11	0	1		3	17
Dist. of Columbia	0	0	0	2	1	0	3
Florida	93	42	1	46		7	189
Georgia	56	17	1	11		39	124
Idaho	69	14	1	1	28	28	141
Illinois	38	111	2	3	1	21	176
Indiana	34	105	0	4		9	152
Iowa	56	57	1	2		63	179
Kansas	99	50	1	6	1	34	191
Kentucky	15	29	1	2		17	64
Louisiana	33	13	1	3	2	27	79
Maine	26	25	0	2	0	12	65
Maryland	7	30	0	7		11	55
Massachusetts	22	45	0	5		2	74
Michigan	119	94	0	5	1	29	248
Minnesota	80	39	0	1	2	0	122
Mississippi	34	23	1	6		19	83
Missouri	49	46	1	1		14	111
Montana	77	14	1	1	15	5	113
Nebraska	72	38	1	1	1	26	139
Nevada	18	18	6	3	20	11	76
New Hampshire	12	16	0	1		5	34
New Jersey	12	68	0	5		6	91
New Mexico	33	20	8	7	3	28	99
New York	48	123	2	7		75	255
North Carolina	36	74	0	11	1	19	141
North Dakota	62	39	6	0	1	29	137
Ohio	40	160	4	4		31	239
Oklahoma	83	35	1	5		23	147
Oregon	42	31	2	0	13	31	119
Pennsylvania	44	161	2	5		9	221
Rhode Island	3	7	0	2		0	12
South Carolina	35	18	1	5	1	1	61
South Dakota	47	16	1	1		6	71
Tennessee	23	28	1	2		10	64
Texas	164	139	5	50	6	255	619
Utah	37	8	6	3	1	5	60
Vermont	9	10	0	1		1	21
Virginia	22	68	2	14	2	18	126
Washington	71	51	1	11	7	37	178
West Virginia	14	27	2	0		14	57
Wisconsin	63	89	2	0	1	19	174
Wyoming	32	12	2	0	3	7	56
TOTAL	2272	2329	76	331	151	1244	6403

State	Sub 1, 1	2	3	4	5	6 & Other	TOTAL
Alabama	45	14	13	11	2	2	87
Arizona	73	43	30	16	15	1	178
Arkansas	56	10	11	9	0	0	86
California	296	88	53	35	34	24	530
Colorado	57	23	20	1	0	6	107
Connecticut	23	1	3	4	1	0	32
Delaware	10	4	0	1	0	2	17
Dist. of Columbia				1	1	1	3
Florida	54	25	41	39	12	18	189
Georgia	52	18	23	24	2	5	124
Idaho	115	14	7	2	0	3	141
Illinois	109	46	8	9	4	0	176
Indiana	103	29	10	8	2	0	152
Iowa	148	16	6	8	0	1	179
Kansas	128	27	14	5	9	8	191
Kentucky	50	4	5	4	0	1	64
Louisiana	42	12	12	8	2	3	79
Maine	41	6	12	2	2	2	65
Maryland	26	15	4	7	0	3	55
Massachusetts	46	8	10	7	0	3	74
Michigan	176	42	14	12	2	2	248
Minnesota	76	34	6	4	1	1	122
Mississippi	46	13	14	8	1	1	83
Missouri	74	18	11	5	3	0	111
Montana	82	13	6	6	2	4	113
Nebraska	106	13	5	2	2	11	139
Nevada	39	6	12	9	9	1	76
New Hampshire	24	4	3	2	0	1	34
New Jersey	63	13	9	4	1	1	91
New Mexico	54	15	6	9	8	7	99
New York	190	30	12	16	5	2	255
North Carolina	88	17	19	11	2	4	141
North Dakota	112	14	3	8	0	0	137
Ohio	174	43	8	10	2	2	239
Oklahoma	90	22	12	13	7	3	147
Oregon	80	9	11	14	4	1	119
Pennsylvania	174	25	14	7	1	0	221
Rhode Island	7	1	1	1	2	0	12
South Carolina	25	13	3	11	6	3	61
South Dakota	49	9	6	3	2	2	71
Tennessee	38	13	5	6	2	0	64
Texas	371	114	49	49	25	11	619
Utah	23	15	13	3	5	1	60
Vermont	17	0	3	1	0	0	21
Virginia	82	19	10	11	2	2	126
Washington	113	25	11	17	5	7	178
West Virginia	43	8	2	3	1	0	57
Wisconsin	123	34	12	3	1	1	174
Wyoming	29	9	13	3	1	1	56
TOTAL	4042	904	575	452	188	152	6403

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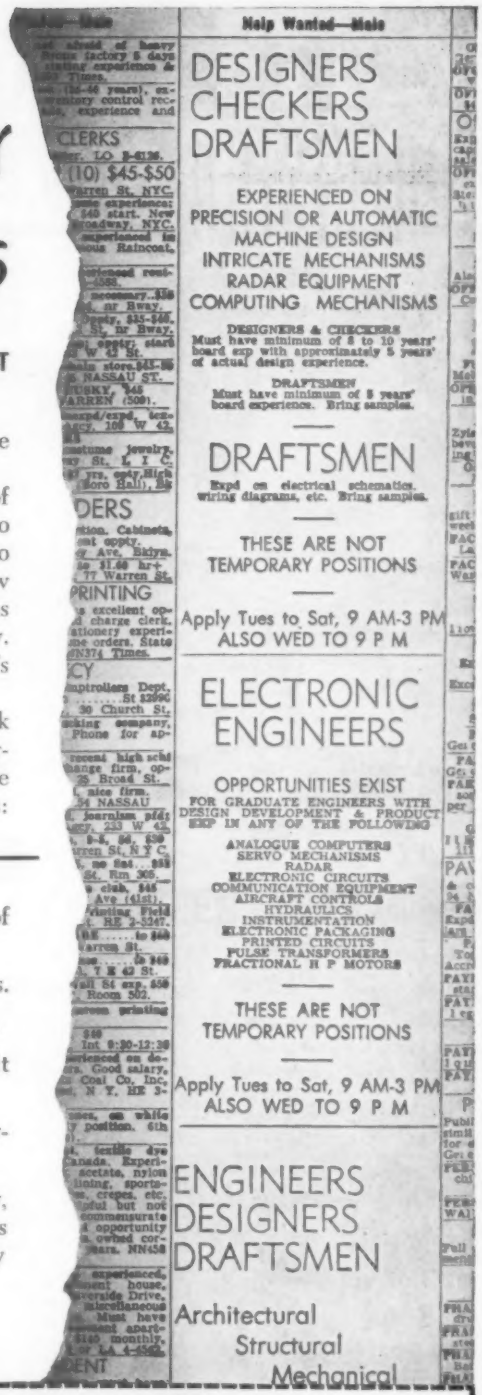

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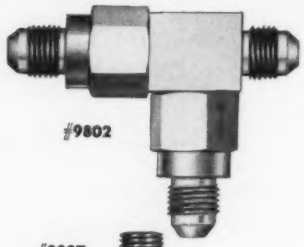

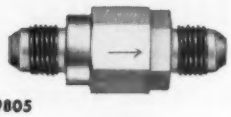

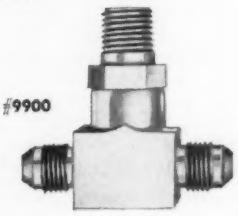

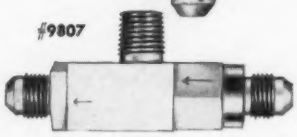

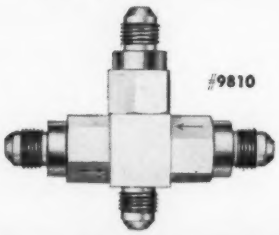

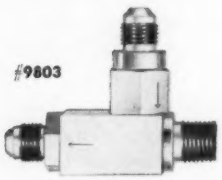

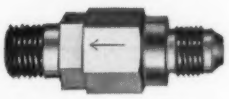

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	1949 Actual	1950 Est.	Percent Change
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Student Pilot Cert. Issued	49,575	45,400	− 8
Private Pilot Cert. Issued	30,278	25,000	−17
Commercial Pilot Cert. Issued	7,123	5,030	−29
Transport Pilot Cert. Issued	1,060	800	−25
U. S. Civil Aircraft	92,622	92,650	

Source: CAB.

Ten States Have Half of U. S. Civil Planes

There were close to 100,000 civil aircraft registered with the Civil Aeronautics Administration as of July 1, 1950. The actual number—92,442—represented a slight drop from the previous year's figure of 92,658.

The ten states with the largest aircraft ownership accounted for more than half the 91,177 planes registered in the continental U. S. California led with 10,508, 11.4 percent of the national total.

Others in the big ten were Texas, Illinois, New York, Michigan, Ohio, Pennsylvania, Kansas, Indiana and Florida. The CAA records showed 62,496 of the registered planes were active.

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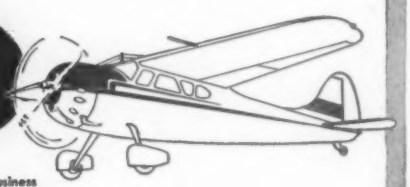

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Missiles Streak Toward Future Role

Developments of current types will supplement, later replace piloted aircraft as weapons of air power.

By David A. Anderton

The guided missile is beginning to find a place in U. S. air power. Indisputable evidence points to the fact that this country's air strength is being bolstered by the addition of guided missiles in three main weapon categories:

• **Air-to-air missiles (AAM).** These supplement—and will eventually replace—standard aircraft armament. Resembling the more-conventional aircraft rockets, these weapons are somewhat longer and of greater diameter. (Typical size is the Ryan Firebird, a developmental missile which paved the way for current and future AAMs. Firebird is 120 in. long, 6 in. dia.) They contain target-seeking equipment, either passive (directed from launcher) or active (completely self-contained). Powerplant is generally solid propellant rocket.

• **Surface-to-air missiles (SAM).** These will eventually replace piloted interceptors and anti-aircraft artillery. Their configurations are legion, varying from the familiar rocket layout to something indistinguishable from an airplane. Powerplant varies, can be rocket, ramjet or combination. Typical sizes might start at 20 ft. long, go on up to 40 ft.

• **Surface-to-surface missiles (SSM).** These will someday be strategic bombers. Right now, they are tactical weapons. Current layouts resemble aircraft from which cockpits have been removed, and feature turbojet powerplants. Eventual types will include multistage rocket-launched configurations using ramjet engines for cruise-out. Wing loadings will be high, operating altitudes and speeds very high.

▶ **Clue By Appointment**—First inkling that guided missiles had left the laboratory and were ready for production came in the appointment of Chrysler Chairman K. T. Keller as director of the Office of Guided Missiles. Keller's previous background was almost exclusively with automotive problems, including tank production during WW II. And he is a production expert.

Nothing much was heard of Mr. Keller for a while after he began his duties with OGM, but he probably was spending his time getting educated in the new field. More recently, he has been making a tour of facilities in this country where guided missile research and development is going on.

Next clues of production plans for missiles came from Pentagon sources who said that Air Materiel Command has given Glenn L. Martin Co. a letter of intent ordering production of the Matador, 500-mi. surface-to-surface missile.

News of the Matador was followed by reports from other sources which emphasized the Navy's lead in air-to-air missiles and said that production tooling was under way for large-scale output of one such weapon. Still other reports spoke of the Army's Loki anti-aircraft rocket and of Hughes' guidance system development for an automatic interceptor, pilot-monitored.

And if that isn't enough, the security lid has been clamped on even tighter within the past few months—not solely because of the emergency, either. Unclassified data that this magazine published on Fairchild's Lark last May have now been classified; the missile itself has been classified in higher categories all along the line.

So, to borrow from an old vaudeville routine, it looks as if we are about ready to start to begin to go.

▶ **Integration Problem**—Go where? Is there a plan, an ideal for the employment of guided missiles? Or do they fit in anywhere that conventional aircraft are utilized?

We are a long way from air power solely in terms of guided missiles. Right now, their use is supplemental, as befits the start of transition from one form of weapon to another. That transition period can be considered ended when all our standard offensive weapons have a missile counterpart. And we are a long way from that stage.

Eventually, the missile could be an offensive and defensive air weapon. But it's never going to be used for troop transport or liaison or communications, at least not on this planet.

Ideally, at some future date the guided missile is going to be the only striking force of air power.

▶ **Data Comparison**—Today's missile is only the beginning. Since 1945, the standard of comparison in the guided missile development field has been the German V-2. And why not—it was the most spectacular of the German developments. Its components showed a much higher degree of technical skill and more years of background research than those of the few other missiles which the Germans had pressed into service.

But from the viewpoint of damage produced at target—and this is the only way to judge a missile—the V-1 buzz-bomb was a superior weapon. It was superior in lots of ways—cheaper, easier to manhandle and fire, burned standard hydrocarbon fuels—but it had one big fault. It could be intercepted and shot down by aircraft and anti-aircraft artillery. So it eventually failed as an offensive weapon.

In this country, the basic concept of the little pilotless aircraft which the V-1 typified was enlarged and developed. The result of that development is exemplified in the Martin Matador. It has the V-1 virtues; it handles like an aircraft on the ground; it's reasonably cheap; it burns standard fuel.

But the seven years between the V-1 and the Matador have resulted in a much faster airframe-powerplant combination that can show its heels to most aircraft and be an impossible target for anti-aircraft. And the same kind of technological improvements that upped the speed have increased the range also.

▶ **Progress in Spots**—So in this category at least we have made progress since the war.

In the field of air-to-air missiles, one has only to look through the files of German developments of weapons of this type to realize that we are well ahead of their wildest dreams. It has taken some time, but we have been able to avoid the complexities of trailing-wire controls, for example. Our latest developments in AAMs are superb.

Anti-aircraft is another story. Towards the end of the latest war, the Germans were pursuing two different types of rocket weapons for area defense against bombers. One was Taifun (Typhoon), a pressurized, liquid-propellant unguided rocket. The other was Wasserfall (Waterfall), a pressurized, liquid-propellant ground-controlled rocket.

Of the two, Wasserfall was farthest along. It had flown successfully as a test vehicle for about 70 percent of its test firings. It had been maneuvered at supersonic speeds by pre-set devices and once or twice from the ground controller. It had gotten to the altitudes and speeds needed for guaran-

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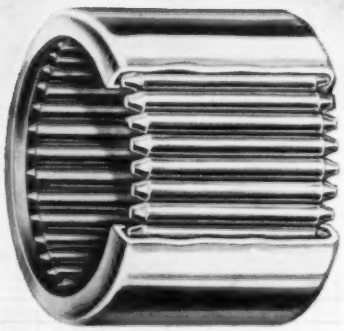

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There is nothing really comparable to Wasserfall today in the U. S. But in this field, there is the Lark, a subsonic, rocket-propelled missile, and in its own particular method of employment, it should be able to stop enemy bombers. And there is the current thinking on the sonic interceptor, and once that craft is perfected (current unrealistic target date is about two years) it is virtually an anti-aircraft missile.

But these are future possibilities, as was the Wasserfall at the end of WW II, and comparison is not possible.

▶ **Intercontinental Progress**—In the field of the low-range missile—and long range means at least 5000 mi.—we have made some progress. That progress is rightfully well-hidden. But in general terms, it can be said that missile configurations now exist which can carry an A-bomb over intercontinental distances at high speeds and with very large inaccuracies. The work of the next decade on missiles of this type will have to be directed towards reducing the inaccuracies of in-flight target location.

In the field of very long-range rocketry the Germans only made paper studies. The most famous of these showed that a modified V-2 with wings could be launched by a gigantic rocket and reach an eventual range of about 3000 mi. But the Germans who prepared the report chose some very-optimistic aerodynamic data, and overestimated their range by a factor of about three.

To date, missile progress in this country has been both encouraging and discouraging. It's encouraging to know that missiles of certain types are ready; but it's discouraging to see the amount of work yet to be done before they can be considered as replacement, instead of supplementary, equipment. And it's discouraging to note the definite lack of great progress in the long-range class.

▶ **Progress from Problems**—Of course, it is only by licking problems that progress is made. And the problems which confront missile designers today are annoying ones.

In aerodynamics, for instance, basic theories have been established for most of the internal and external flow processes. The validity of these theories has been checked in some limited cases; in others, theory is still educated guessing. Much wind tunnel testing has been completed on specific configurations, and the aerodynamics of established layouts are well understood. But exact calculations for the drag contribution of the blunt end of the rocket missile can't yet be made, and interference effects are still puzzling. Lift forces and center of pressure locations on ducted bodies are equally difficult to obtain theoretically. And of course, transonic aerodynamics is still not understood.

Structurally, the missile is in good shape. Current prototype missiles are patterned after conventional aircraft structure, which is well-known. But two major stumbling blocks remain in structural design:

• **Designing an airframe** which will hold together at temperatures near red heat, and which goes through an extreme temperature range in a short period of time.

• **Providing a better design** for the combustion chamber to enable higher exhaust temperatures—and therefore higher thrusts—to be used.

▶ **Propulsion Worries**—The three major types of missile powerplants—turbojet, ramjet and rocket—have their own peculiar problems. Those of the turbojet have been so well-documented over the past years that they are as old friends. The turbojet comparatively suffers from lack of high thrust, low fuel consumption and high turbine-inlet temperatures. Work to eliminate these faults goes on day and night, and eventually, they'll be licked.

One big deterrent to ramjet development has been the lack of facilities. Here the designers have far outstripped

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current testing capabilities. And so a ramjet engine will look fine on paper, and develop high efficiencies in a cold run in a wind tunnel. Its combustor will show high efficiencies in scaled-down tests. But nobody knows how the pieces will work when they are hooked up together.

There is a long road ahead in ramjet development.

Rocket progress seems to be concerned right now with eliminating sound effects. The motors squeal, whistle, buzz and chug and the cures are not too well understood. The indications are that these howls of protest only occur when the motor is being pushed—and when the last ounce of thrust is being milked from the motor.

► **Heavier and Hotter**—Fuel problems revolve primarily around the heat content of the fuel; secondarily around its storage and handling qualities.

Missile designers would like their fuels to be very dense, so that the highest number of total BTUs could be packed into the smallest volume (for in a missile, volume is often more important than weight). The powerplant designers would like their fuels to have a very high heat content, so that their engine will give out more thrust for less weight and volume.

But dense fuels are often hard to vaporize and maybe they contain particles in suspension which are hard for the fuel nozzles to handle. And fuels with a higher heat content than gasoline or kerosene are difficult to handle, temperature-wise, without burning out the combustion chamber.

Some rocket propellants are almost impossible to store and handle with any safety in the field.

Guidance problems also exist. And within the strict confines of security, that's the end limit of the discussion.

The general problem in guidance is one of very accurate, very long-range navigation with nothing available at the end of the journey to home on or to ride down. How it can be done is still a mystery.

► **Practical Production**—Building guided missiles demands many more exacting techniques than airframe production. A general review of the problems was covered in AVIATION WEEK's 1950 Procurement for Air Power issue (Sep. 25, 1950). The picture hasn't changed since then.

One thing that could be added to the consideration of missile production is the question of how much industry is needed. Is it fair to assume that—if the missile eventually replaces the airplane in many tasks—the missile industry can start out within the aircraft industry and eventually absorb it?

The answer is yes and no. No, for now, because the aircraft factories are straining now to meet present production commitments. There will have to be a separate missile industry set up on top of the aircraft industry, partly because of the techniques and machinery required, partly because of the original placement of contracts.

Gradually, this missile industry within an industry will get too big to remain a branch operation. (There is a parallel here with the development of electronic equipment by the aircraft companies. Those who did now are finding that their original small specialty department is now an industry.)

An autonomous missile industry will eventually develop; it will just grow that way, and not spring into being full-grown. And the growing pains should be terrific as the aircraft companies fight to hold on to work that they feel should be theirs.

► **Finalizing**—This, then, is a qualitative review of the guided missile as a weapon in air power. Much remains to be done before the services will be depending on these sleek pilotless planes as they now depend on piloted ones.

But within the past decade, guided missiles have developed from dreams to designs to data. Another five years should see missiles firmly established within the organization of air power. And in five more years—maybe ten—the guided missile will be air power.

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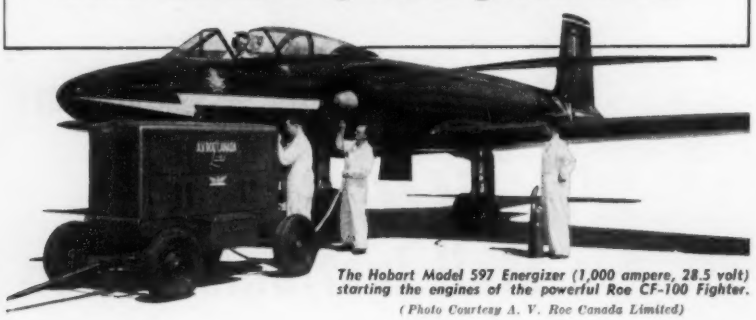

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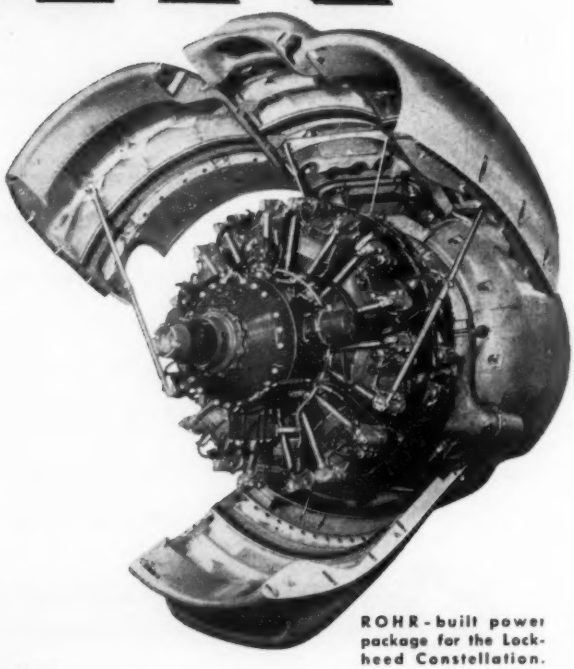

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The Growing Demand for Avionics

In Fiscal 1951, USAF has budgeted . . .

Electronic equipment for new planes at a minimum of	$459,000,000
Other electronic equipment at a minimum of	488,000,000

And Navy Bureau of Aeronautics has budgeted . . .

Electronic equipment for new planes at a minimum of	325,000,000
Other electronic equipment at a minimum of	125,000,000

For electronic expenditures of at least $1,397,000,000

'Growing Pains' Torment Avionics

Vastly expanded need for electronic systems speeds development pace despite trained engineers shortage.

By William Kroger

The burgeoning field of avionics is making it possible for engineers and manufacturers to dare to plan devices and performances that only a few years ago were shimmering dreams.

It is making it possible for the Air Force and Navy to rely on avionics (aviation electronic devices) more heavily than do any other air forces in the world.

It is why the cost of avionic gear in military aircraft has steadily risen in ratio to the cost of the complete plane until today it is approaching one-half the total cost in some plane types.

It is why the weight of avionic gear in the Navy's P2V patrol plane, for example, has jumped from 1600 lb. to 4200 lb. in five years.

And the growth of avionics is why Maj. Gen. Gordon P. Saville, Deputy Chief of Air Staff for Research and Development has said:

"If I were a banker and had to conduct an air offensive operation, one thing I would do is this: I would go out and hire a couple of pilots, pay them $8000 a year; I'd hire a navigator, pay him about $10,000; and I'd hire *an electronic systems engineer, and I'd pay him about $25,000 to get the job done.*"

► **How It Has Grown**—That estimate of the importance and the rapid growth of electronics in air power has been signified by the military in two other ways: the huge sums being spent (the $1.3 billion shown above admittedly is low; both security and the fast pace of electronic development hide the real figure); and the fact that to meet its defense needs the Air Force says now it must have by December, 1953 electronic equipment it originally planned to get by December, 1954.

The merging of electronics and aviation into a new, mushrooming industry that has become a vital concomitant of air power has brought its own penalties:

- The avionic industry has done everything asked of it so well that the military now has laid down electronic equipment specifications that would have been termed impossible not so long ago.
- The industry has grown so fast that it is not old enough to have developed enough seasoned engineering personnel. So it is handicapped in speeding work on equipment to meet the new specifications.
- The success of the merger of aviation and electronics hints at profound changes in the technology and manner of doing business of both the aircraft and equipment industries. The new specifications exert important influence on this situation.

► **What's Wanted**—Here are the new design goals for military avionic equipment:

- **Temperature**—Minus 60 deg. to plus 200 deg. C.
- **Altitude**—70,000 ft.
- **Life**—1000 hr. minimum.
- **Shock**—50G for 10 milliseconds.
- **Size, weight**—Minimum.
- **Maximum efficiency.**
- **Hermetically sealed.**

Obviously, the design, perfection and production of equipment meeting those specifications is a joint job of airframe and equipment engineers. When electronics began to be vital to aircraft in the late stages of World War II, the

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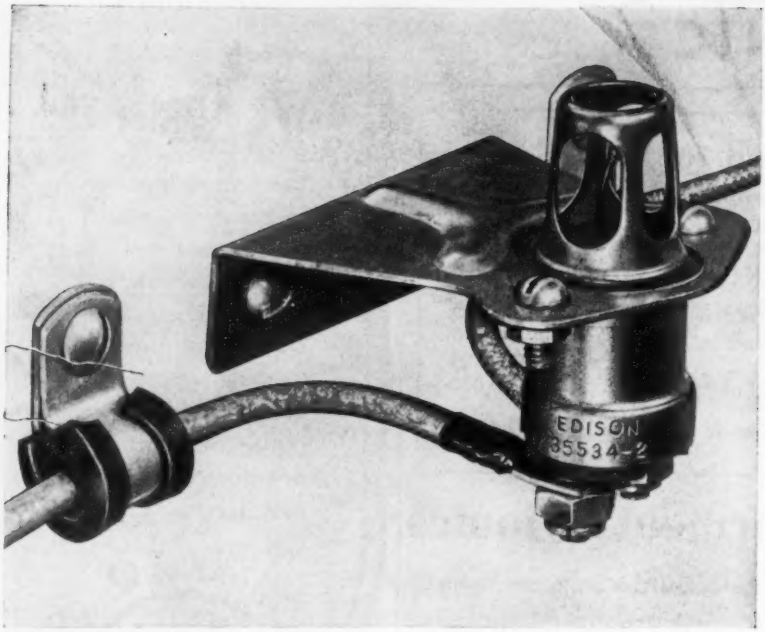

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TEMPERATURE INDICATING AND ALARM SYSTEMS

airframe manufacturer knew little about electronics; the electronics manufacturer knew little about aircraft design and construction. Each has had to learn the other's trade. And in learning, in trying to develop ever more efficient equipment, they sometimes have become competitive.

So today, through the whole avionic equipment field—separating what we have from what the services say we should have—race two streams, one technological improvement, the other procurement policy. Sometimes the streams course parallel, sometimes they cross each other, sometime they join until each is indistinguishable.

► **The "Systems Concept"**—Figuratively sitting on the bank at one of the spots where the streams join, is Gen. Saville. He would pay $25,000 to an electronic "systems" engineer. He, along with Maj. Gen. Horace A. Shepard, USAF Director of Procurement and Engineering, and such industry leaders as Preston R. Bassett, president of Sperry Gyroscope, have been emphasizing that electronic equipment for aircraft now consists of systems rather than individual devices.

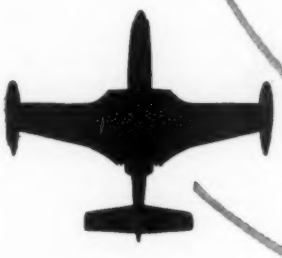
And this "systems concept" is the well-spring of what's happening to the technology and procurement procedures in the avionic and aircraft industries. It is the source of the streams.

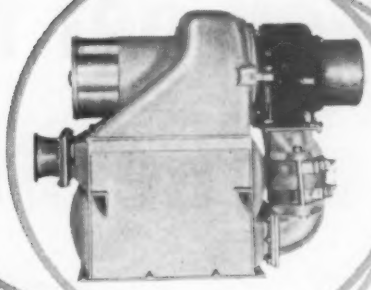
"Systems," while not new in the lexicon of electronics, is new in identity and function. Electronic engineers for years have talked about systems; but only gradually to them and to the military has come the realization that an "electronic navigation aid" is really an "electronic navigation system," that a "radar bombsight computer" is really an "electronic bombing system," and that practically all electronic installations in today's planes are systems—two or more devices integrated to perform a specific or a series of specific jobs.

An electronic system designed to do a specific job obviously is suited to a specific aircraft or aircraft type designed to do a specific job. Sometimes, the system plays an even more important role: it is tailored to a specific aircraft, or the aircraft is tailored to a specific system. The Navy, in ordering the F3D Skyknight, reportedly gave Douglas the avionic gear and asked that a plane be built around it.

► **To Each His Own**—In view of that integration of electronic systems and aircraft performance, military procurement officials are tending more and more toward giving one firm the contract for both the aircraft and avionic system. So some airframe manufacturers are developing the electronics for their own planes; some electronics people have prime contracts on guided missiles covering airframe as well as electronics.

In the words of one top Air Force





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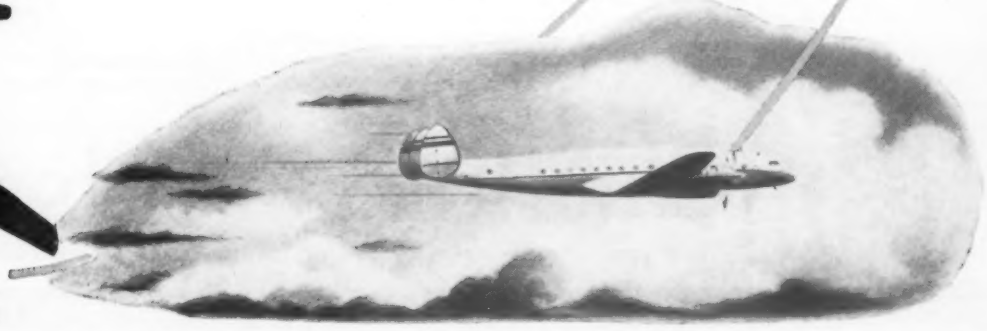

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UNITED STATES STEEL

procurement officer: "We want somebody responsible for making the whole thing work." The "thing" is the aircraft combined with the system.

That is one way in which the systems concept is deeply affecting the business of both the airframe and equipment companies. It is spelled out in procurement policy in terms of Government Furnished Property (GFP) vs. Contractor Furnished Equipment (CFE).

▶**How Times Change**—From the spindly beginning, during the war, with radar, the services put electronics to more and more important tasks. At first the government bought the electronics, and furnished them to the airframe manufacturers for installation in the planes. The installations kept getting more and more complex until the systems concept was born.

Then, because the systems were suited to only one or a few plane types, many times it became impractical to buy the systems direct from the equipment manufacturer. Technologically, it was more beneficial to let the equipment manufacturer and the airframe manufacturer work out the problems in concert. So electronics spawned systems, and systems—at least in the electronics field—is spawning more CFE items.

Instead of doing business direct with the government, many equipment manufacturers now find themselves working on subcontracts from prime airframe manufacturers.

▶**Cooperation vs. Coordination**—Many, perhaps most, of the equipment manufacturers are in accord with this CFE procedure in procurement of electronics. Along with the military they see in this subcontracting a tremendous technological advantage. It brings the closest kind of cooperation between the airframe and the equipment manufacturer, with a superior final product as the result.

Both airframe and equipment people say that use of GFP, standard items, makes more likely technological inferiority.

The equipment engineers and buyers of the Air Force stoutly disagree. They say frankly that they want to encourage cooperation between airframe and equipment people—but only through Wright Field. Wright Field would be the coordinator of the work of both sides. Let the airframe and equipment engineers work together directly and you might get a better product, but one very expensive, difficult to maintain, and presenting all sorts of impossible supply problems.

And they scoff at the theory that technological progress is stifled by GFP. Air Force engineers, you are told at Wright Field, are far more advanced than the industry.

▶**On The Other Foot**—But the procure-

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Stainless steel nozzle assemblies for jet aircraft engines. ABOVE: nozzle tip assembly. ABOVE, RIGHT: duplex nozzle assembly. TO RIGHT: dual flow nozzle assembly. All details of these units have been manufactured and assembled by Ex-Cell-O to the rigid specifications of the aircraft industry.

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Ex-Cell-O has complete parts production facilities, including rough and finish machining, heat treating, and metallurgical control, all done directly under one responsible management. All these facilities are being utilized by the aircraft industry in its rapid progress in commercial and military air power.

Below: **Some typical precision aircraft parts manufactured by Ex-Cell-O to customers' specifications.**

51-7

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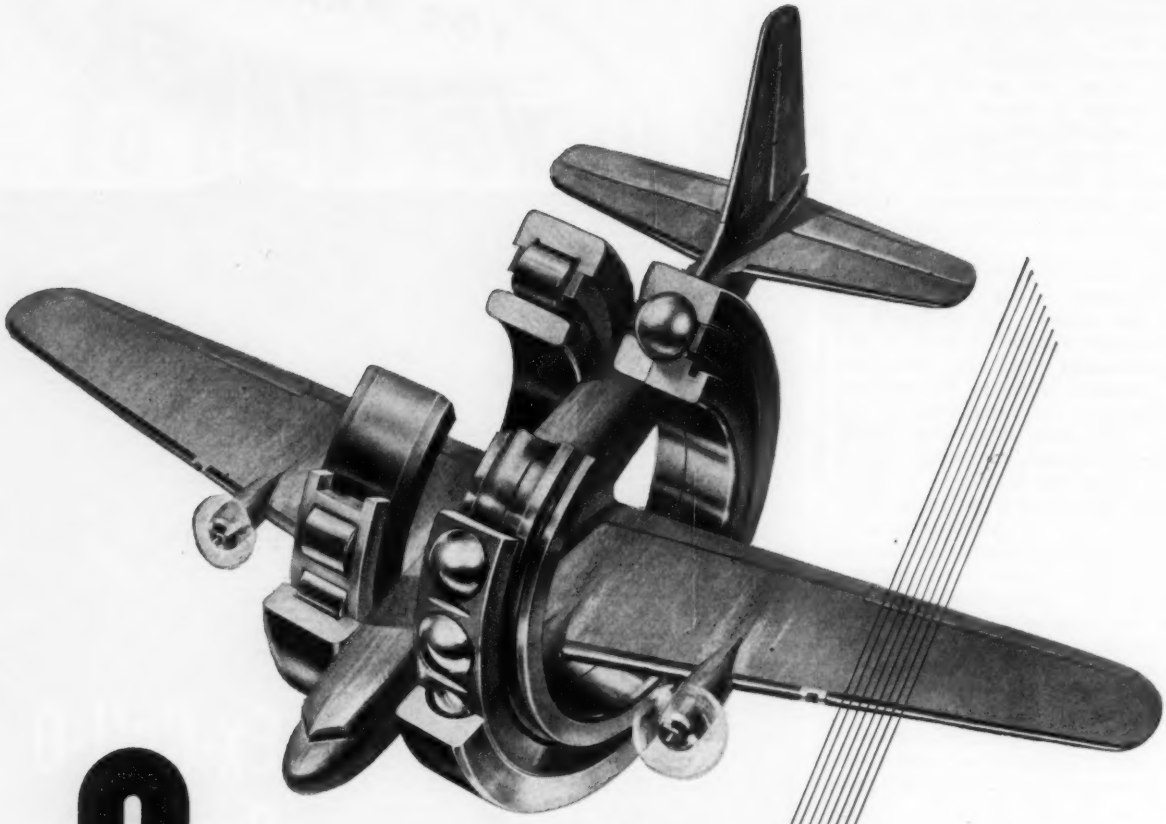

9/10

The engine manufacturers who produce approximately nine-tenths of the power for AMERICA'S aircraft use SKF BEARINGS.

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ment of avionic systems through the prime airframe contractor doesn't always lead to subcontracting to equipment manufacturers. The streams of technological improvement and procurement policy merge when the airframe manufacturer decides he can do the electronic systems development more efficiently and economically in his own laboratories. So some equipment manufacturers find that the type of work they have always done in the past now is being done by companies they used to supply.

This harbors a potential bottleneck in supply, for airframe companies lack long-time production experience in avionics. But that could be overcome by subcontracting a developed item for production by an experienced equipment manufacturer.

What might be even more serious is a complaint by the equipment manufacturers that the airframe companies have taken irreplaceable engineers and know-how from the equipment industry.

And when the airframe industry, which also suffers from an acute shortage of electronic engineers, bewails that fact, the equipment people retort that if the airframe companies had stayed out of electronics they wouldn't have an electronic engineer shortage.

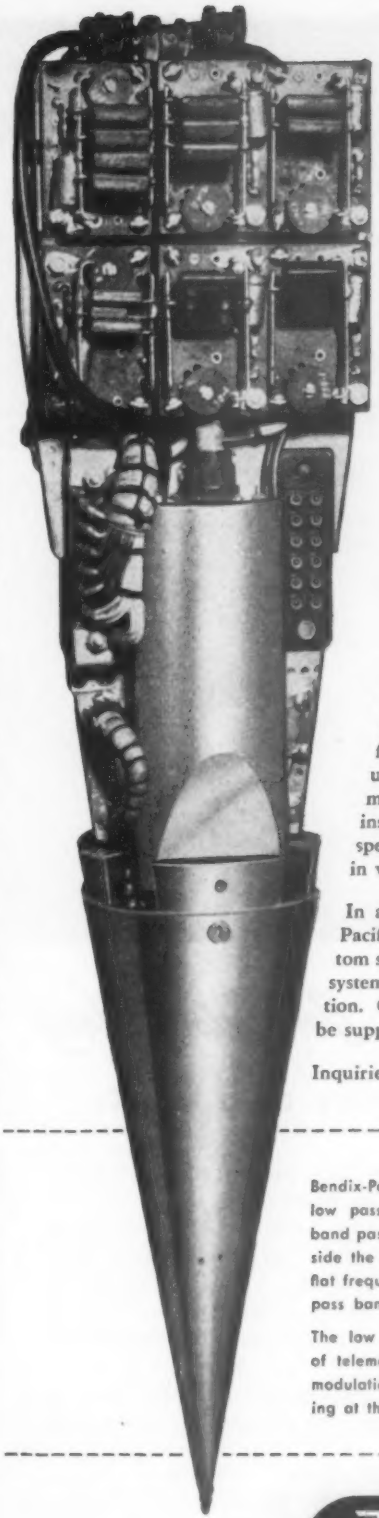
►**Ghost Image**—Overall, the engineer shortage is perhaps the most critical factor in avionics' air power potential. Concentration by electronic firms on consumer demands, principally television, generally is the horrid specter seen in this situation. But perhaps closer to the truth is that the avionics industry has come along too rapidly.

It can be argued that there is no real shortage of electronic engineering graduates. But the type of engineer needed to work on the systems envisioned by the military is not a recent engineering graduate.

He is an engineer with years of experience. And there just aren't enough of those. Electronic systems for aircraft are not that old.

It is true that more progress on the design goals might have been made if large electronic manufacturers four or five years ago had taken military research and development contracts—when they were asked to—instead of concentrating on television and other consumer products. That they chose civilian work is one reason why the aviation electronics field had to be broadened by work given to airframe and other manufacturers of non-electronic products.

In the final balance, that may be an asset. Or at least many Air Force and Navy officers think that the greater diversified effort brought to bear on the problems will bring a quicker solution.



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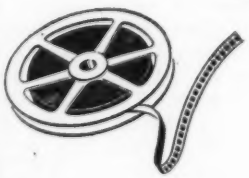

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Helicopter Value Recognized by Military

Growing awareness of utility of rotary-wing craft is spotlighted by plans to order 600 in fiscal '51.

The U. S. helicopter industry is on its way to the big time.

Under the impetus of new Air Force, Army and Navy requirements, American rotorcraft are headed for their biggest year yet in 1951, with prospects that 1952 will be bigger yet.

Unofficial but accurate estimates indicate that military orders for approximately 600 helicopters valued at over $100 million are being scheduled for fiscal year 1951. Additional orders are anticipated when further supplementals to the 1951 appropriation are asked from Congress. And, barring marked change in world status in the next few months, a new batch of helicopter orders in comparable numbers and dollar value, or perhaps even larger, is in line for 1952 fiscal year also.

► **Civil Adaptability**—One significant thing about the military expansion, is the adaptability of virtually all the military helicopters on order, to civilian purposes, without handicap or penalty.

Suitable for civil passenger helicopter routes are the big helicopters which are being ordered in increasing numbers for such military purposes as troop assault transport, long-range rescue, anti-submarine patrol.

Other large machines, designed primarily as flying cranes to hoist pieces of heavy military equipment over natural barriers such as rivers and hills, will likewise have considerable usefulness in similar civilian projects.

Smaller machines, being ordered for liaison, observation, training, and short-range rescue work, are for the most part virtual off-the-shelf purchases of small civilian models which are already being used for civilian training, agricultural purposes, rescue and special light transportation jobs which no vehicle lacking the special performance characteristics of the helicopter can perform.

► **Eight Major Models**—Major military production orders for 1951 center around some eight models produced by five prime contractors—Sikorsky, Piasecki, Bell, Hiller, Kaman. But many of the most interesting helicopters are still in experimental development, including machines larger than any now flying and machines powered with various types of jet engines. Even more radical designs are in drawing board status.

Army has already set up requirements for large quantities of troop- and cargo-carrying transports of Sikorsky H-19 and Piasecki H-21 size, but orders for these have been blocked thus far by an Air Force limitation on the weight of aircraft which the Army may buy directly. Increasing pressure on the Air Force to lift this restriction is expected to unfreeze the additional heavy transport helicopter orders shortly.

Immediate orders on the basis of 23 helicopters for a transport company then are expected to provide one company for each of five divisions, or a total of approximately 115 large copters. With the expanded Army organization calling for 18 to 20 divisions, the transport company helicopters may eventually be as many as 400 or more.

► **Opening Military Eyes** — What brought about this sudden military appreciation of the helicopter's usefulness? Actually it wasn't so sudden for a little group of service pioneers in the Navy, Air Force, Army and Coast Guard, and for the three pioneering manufacturers—Sikorsky, Bell and Piasecki. But it took something like the Korean crisis to focus attention on what today's smaller helicopters could do. Then it wasn't so hard to point out the advantages of tomorrow's larger machines, a few of which were already flying.

While statistics on helicopter rescues in Korea are filtering back slowly, it can be reported that as of Jan. 1, a total of approximately 1200 helicopter rescues had been made, including medical evacuations, with probably about 10 percent of these having been made from behind enemy lines. Virtually all of these were accomplished by Sikorsky H-5 helicopters, since other makes saw little service in the combat areas before year's end.

Except for one factor—Navy's limitation on overall size of its copters due to the limits of its carrier elevators—there is probably more uniformity in the three services' requirements for helicopters, than most other equipment that they buy.

► **Uniform Needs**—For example—all three services are buying or will buy, Sikorsky's largest production craft, model S-55, which the Air Force and the Army call the H-19A, the Navy designates as the HO4S, and the Marines call the HRS. It is a ten-passenger machine powered with a 600-hp. engine; it cruises at about 100 mph. Both Navy and Air Force are ordering Sikorsky's smaller copter developed from the S-52, holder of the world's copter speed record of 129.47 mph. It has service designations of H-18 and HO5S.

The Navy is buying large quantities of Piasecki's HUP seven-place tandem copter, though this shipboard machine does not fit into requirements of the other services.

Air Force has ordered quantities of the larger Piasecki H-21 for long-range rescue, and is developing the huge Piasecki H-16 twin-engine craft, but this is not now programmed for, until at least mid-1952. Emergency may speed this schedule to make up delays attributed to earlier military indecision. The H-16 is designed to carry approximately 40 men in its DC-4-sized fuselage, and in a "long-legged" version will be able to pick up a large detachable pod under its fuselage and deliver it within a reasonable radius.

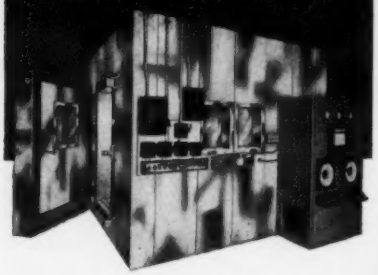
Army wants both the H-16 and the H-21 when the weight restriction is lifted by Air Force.

► **Bell's Copters**—Bell's major production military helicopters are developments of its three-place Model 47-D commercial helicopters. Now the military versions can carry five, including exterior litters. Models H-13 and H-15 ordered by Army and Air Force, and HTL ordered by the Navy for the Marine Corps, are all derivations of the basic model. Although the H-13 and H-15 are different machines with different powerplants, they have identical rotor systems.

A new larger machine which Bell is just developing and has orders to produce in small quantities is a powerful anti-submarine helicopter for the Navy. It has a tandem rotor configuration much like the Piasecki, except that the rotors are the Bell type with two blades and balancing bars. The XHSL-1, as the new machine is designated, will carry search radar plus sufficient armament to dispose of any submarine it may discover, and is designed for long range and heavy load-carrying, more than for high speed.

Remaining production orders disclosed thus far are split between small helicopters of Hiller and Kaman. These include the Hiller H-23A for the Army and Air Force, and the HTE for the Navy, both versions of the commercial Hiller 360 machine, and the Kaman H-22 (Air Force designation) and HTK

FOR COMPLETE TESTING



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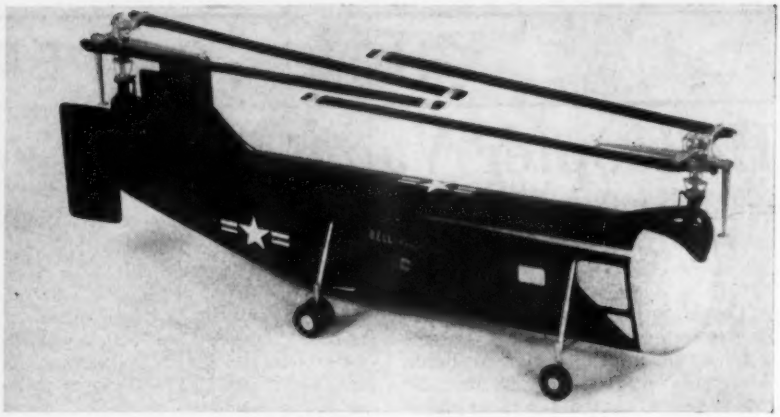
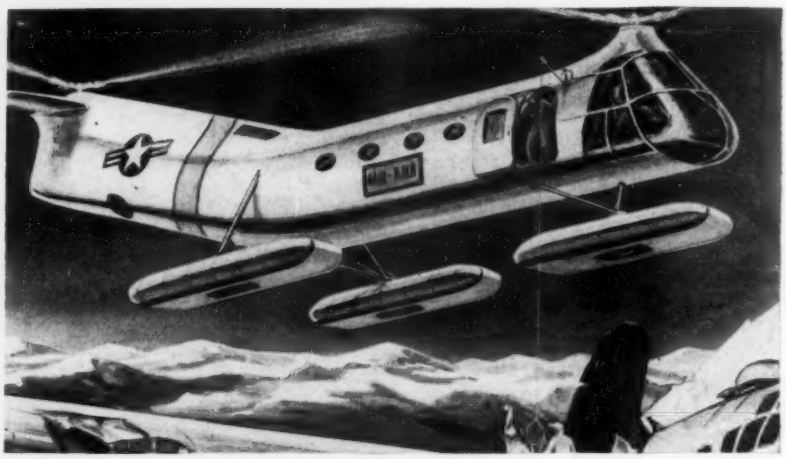


Bell XHSL-1 anti-sub copter.



Piasecki H-21 Arctic rescue copter.

and HOK training and observation types for the Navy.

► **Things to Come**—Farther in the future are small jet types, including craft with ramjet and pulsejet engines at their rotor tips, such as the McDonnell XH-20 Little Henry ramjet, American Helicopters' pulsejet, and small Hiller and Pentecost jet machines.

Dwarfing all of these is the Hughes XH-17 jet-powered Flying Crane, the biggest single-rotor machine in this country, which is due for a second series of tethered flights this year, following an accident which damaged the machine last year.

Ability of these jet machines to lift very heavy loads for short distances is a key to an important new future utility for rotary craft.

Additional steps toward establishment of helicopter shuttle passenger services between airports, and downtown areas, and networks of suburban transportation moved ahead in 1950 in New York, Los Angeles and Chicago, along with operative helicopter mail services in these areas.

► **ACC Study**—A study just opened by the Air Coordinating Committee to justify the suport of helicopter developments by federal funds, is expected, through its findings, to move passenger route progress ahead more rapidly, if the military situation will permit.

Need for a suitable twin-engine passenger transport helicopter, for the additional safety provided, is seen. But, some studies by single-engine helicopter advocates indicate that the unique ability of the helicopter to land slowly in small areas in auto rotation in case of engine failure greatly lessens this hazard, as compared with that for fixed-wing craft with higher landing speeds and greater landing area requirements.

A recent CAB examiner's report on applications to begin helicopter passenger and mail service in New York recommended a five-year certificate for one of the applicants, New York Airways. If Board approval is given, it is believed that mail and cargo will be moving over the route by Jan. 1952, and passengers in another six months, if the earlier service goes well. CAB Examiner Moran, after a study of the exhibits and evidence, believes that large helicopter buses will eventually replace all fixed-wing planes for feeder-type routes.

Such a possibility is also being con-

RIGHT for the Constellation...

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► For both the airline operator and the military, the Sperry Engine Analyzer pays off in increased aircraft utilization . . . tighter departure schedules . . . savings of thousands of dollars annually.

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U. S. Helicopter Pilots
(As of December 31, 1950)

Alabama	6
Arizona	6
Arkansas	3
California	94
Colorado	6
Connecticut	25
Delaware	
D. C.	4
Florida	16
Georgia	13
Idaho	5
Illinois	54
Indiana	12
Iowa	9
Kansas	11
Kentucky	4
Louisiana	6
Maine	5
Maryland	3
Massachusetts	29
Michigan	19
Minnesota	8
Mississippi	4
Missouri	19
Montana	3
Nebraska	4
Nevada	1
New Hampshire	2
New Jersey	29
New Mexico	2
New York	123
North Carolina	21
North Dakota	4
Ohio	23
Oklahoma	34
Oregon	11
Pennsylvania	36
Rhode Island	12
South Carolina	4
South Dakota	2
Tennessee	5
Texas	55
Utah	3
Vermont	5
Virginia	12
Washington	40
West Virginia	2
Wisconsin	15
Wyoming	4
TOTAL	816

Source: CAA

sidered by the Air Transport Prototype Advisory Committee which is seriously considering adding a program of transport helicopter prototype testing to its other plans for testing fixed-wing feeder, cargo and jet transports.

Space does not permit detailed review of the technical developments which are advancing the capability and characteristics of the helicopter, but these may be mentioned:

- **Autopilot developments** by Navy and Air Force which are making reliable instrument flight in helicopters possible for the first time, along with night and all-weather flying.
- **Studies of various means** of applying combinations of direct forward thrust in combination with the helicopters, such as pusher propellers at the tail, stub wings with tractor propeller installations, auxiliary jet installations.
- **Studies of means of unloading** the helicopter blade, such as stub wings.
- **Studies of rotor blade de-icing** and other studies for improving rotor blades, from standpoints of production and higher blade efficiency, up into supersonic whirl speeds.
- **Research on convertaplanes** which can hover, take off and land like helicopters, but which can turn the rotors forward to act as conventional tractor propellers, for forward flight.

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1888 . . . DEPENDABLE BATTERIES FOR 63 YEARS . . . 1951

Leading Helicopters of the U.S.

Manufacturer and Address	Designation: Manufacturer	Designation: Military	Seats (includes crew)	Powerplant: No. of engines, make and model	Powerplant: Takeoff hp. @ sea level	Powerplant: At rpm.	Powerplant: Normal rated hp.	Powerplant: At rpm.	Powerplant: At altitude (ft.)	Fuel: Fuel capacity (gal.)	Fuel: Fuel consumption @ cruise (gph.)	Performance: High speed (mph.)	Performance: At altitude (ft.)	Performance: Cruising speed (mph.)	Performance: At altitude (ft.)	Performance: Initial rate of climb (fpm.) at gross weight	Performance: Hovering ceiling in ground effect (ft.)	Performance: Absolute ceiling (ft.)	Performance: Normal range (mi.)	Weights: Gross weight (lb.)	Weights: Empty weight (lb.)	Weights: Rotor disk loading (lb./sq. ft.)	Weights: Power loading (lb./hp.)	Main Rotor: No. of rotors	Main Rotor: Blades per rotor	Main Rotor: Rotor diameter	Main Rotor: Total rotor blade area (sq. ft.)	Main Rotor: Rotor rpm. (cruising)	Anti-torque Rotor: No. of blades	Anti-torque Rotor: Rotor diameter	Anti-torque Rotor: Area (sq. ft.)	Anti-torque Rotor: Rotor rpm. (cruising)	Fuselage: Length	Fuselage: Height to top of main rotor	Status
American Helicopter Co. 3613 Aviation Blvd. Manhattan Beach, Calif.	XA-5	.....	2	2 AHC 9.4 in. pulse jets	95	....	....	....	....	....	....	80	SL	....	....	....	.....	14,000	....	1800	600	1.76	19	1	2	36′	....	....	....	....	....	....	....	....	X
Bell Aircraft Corp. P. O. Box 1 Buffalo 5, N. Y.	47-D1	.....	3	1 Fr 16V4-178-B32	178	3000	178	3000	SL	28	12.2	92	SL	....	....	1025	13,000	14,500	192	2200	1380	....	.....	1	2	35′ 1.5″	35.3	285	2	5′ 8.25″	2.4	1800	41′ 4.75″	8′ 6″	IP
	48A	YH-12B	8–10	1 P&W R-1340-55	600	2250	.....	.....	.....	121	....	120	SL	85	SL	900	3350	11,000	300	6513	4674	3.68	12.36	1	2	47′ 6″	71	279	2	8′ 6″	10.5	1375	39.55′	11.3′	IP
	.....	H-13D	3	1 Fr O-335-3	200	3100	200	3100	SL	29	12.5	98	SL	78	SL	1000	5400	13,000	161	2202	1494	2.11	11.07	1	2	35′ 1.5″	35.3	322[1]	2	5′ 8.25″	2.4	1800	41′ 4.5″	8′ 2.5″	IP
	.....	HTL-3	2–3	1 Fr O-335-2	200	3100	200	3100	SL	33	11	98	SL	85	SL	870	7600	15,500	210	2350	1625	2.42	11.75	1	2	35′ 1.5″	35.3	322[1]	2	5′ 8.25″	2.4	1800	27′ 7″	9′ 2″	IP
	.....	HTL-4	2–3	1 Fr O-335-5	200	3100	200	3100	SL	29	11	93	SL	78	SL	960	7600	15,500	151	2086	1507	2.16	11.07	1	2	35′ 1.5″	35.3	322[1]	2	5′ 8.25″	2.4	1800	27′ 4″	8′ 6.5″	IP
Doman Helicopters, Inc. Danbury, Conn.	Pelican	.....	7	1 Fr 6AL-500	245	3000	....	....	....	....	....	85	.....	75	....	1135	3300[2]	14,000	225	3200	1800	2	.....	1	4	45′	.....	210	3	8′	4.7	1360	.....	.....	....
Gyrodyne Co. of America, Inc. 80 Wall St. New York, N. Y.	GCA-2	.....	5	2 P&W B-4	450	2300	450	2300	2300	100	27	112	2300	89	2300	1250	11,000	22,100	270	5400	3600	2.98	12	2	2	48′	.....	192	0	.....	.....	.....	18′	14′ 2″	UD
	GCA-3	.....	20	2 P&W R-1340-S1H1	600	2300	1100	.....	.....	200	57	170	SL	157	SL	1090	14,000	.....	325	12,800	7800	4.24	10.64	2	2	62′	.....	192	0	.....	.....	.....	31.10′	16′ 9″	X
	GCA-5	.....	3	1 Con XO-470-5	274	3200	250	3200	SL	80	19	161	10,000	155	7700	1200	14,700	21,000	264	2795	2035	2.75	10.2	1	4	36′	.....	312	2	7′	....	2350	30′ 5″	9′ 4″	X
Hiller Helicopters (United Helicopters, Inc.) 1350 Willow Rd. Palo Alto, Calif.	360[7]		3	1 Fr 6V4-178-B33	178	3000	178	3000	SL	28	12	84	SL	76	SL	745	4700	11,000	210	2400	1432	2.49	13.5	1	2	35′	32.3	327	2	5.5′	....	1895	28′ 9″	9′	IP
Heppi-Copters, Inc. Boeing Field Seattle, Washington	103C	.....	1	1 special 4-cylinder	40*	....	40	3000	SL	2	....	90†	.....	60†	....	200†	.....	.....	1 hr.	.....	190	.....	.....	2	2	18′	.....	500	0	.....	.....	.....	.....	8′	X
Kaman Aircraft Corp. Windsor Locks, Conn.	K-225	.....	3	1 Lye O-435	225	3000	....	....	....	....	13	73	.....	65	....	1000	4000[2]	12,000	200	2500	1800	1.97	11.1	2	2	38′	.....	236	0	.....	.....	.....	.....	.....	....
McDonnell Aircraft Corp. St. Louis, Mo.	Little Henry	XH-20	1–2	2 McD ramjet	....	....	....	....	....	....	....	50+	.....	....	....	....	.....	.....	....	630+	280	....	.....	1	2	18′	.....	640	0	.....	.....	.....	12′ 6″	7′	X
	Whirlaway	XHJH-1	10	2 P&W R-985-AN-14B	450	2300	450	2300	SL	195	40	100+	SL	80+	SL	....	.....	.....	350	11,000	8000	3.3	12.2	2	2	40′	.....	220	0	.....	.....	.....	32′	13′	X
Penn Elastic Co. 20 Maplewood Ave. Philadelphia 44, Pa.	B-1	.....	2	1 Fr O-335	150	2575	....	....	....	36	9	.....	.....	.....	.....	.....	.....	.....	360	2000	1300	2.93	13.3	2	2	29′ 6″	26.26	320	0	.....	.....	.....	19′ 3″	7′ 11″	X
Piasecki Helicopter Corp. Morton, Pa.	PV-3	HRP-1	10	1 P&W R-1340-AN-1	600	2250	550	.....	.....	70	....	104	5000	87	2500	430	.....	10,400	265	6900	5041	2.67	10.8	2	3	41′	.....	....	0	.....	.....	.....	48′	14′	NP
	.....	HUP-1	7	1 Con R-975-34	525	2300	500	.....	.....	100	24	125	SL	100	SL	1200	.....	12,000+	400	5450	3924	....	10.7	2	3	35′	.....	....	0	.....	.....	.....	32′	.....	IP
	PV-15	XH-16	25[5]	2 Wr R-1820-76	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	3	.....	.....	....	0	.....	.....	.....	.....	.....	UD
	PV-17	HRP-2	10	1 P&W R-1340-AN-1	600	2250	550	.....	.....	100	30	105	SL	85	SL	950	.....	.....	300	7129	5205	....	12.69	2	3	41′	.....	....	0	.....	.....	.....	54′	.....	UP
	PD-22[4]	H-21	16–22	1 Wr R-1820-76A	1425	2700	....	.....	.....	277	....	130	5000	104	5000	....	.....	16,000[6]	610	.....	.....	.....	.....	2	3	44′	.....	....	0	.....	.....	.....	54′	.....	IP
Seibel Helicopter Co., Inc. P. O. Box 1656 Wichita, Kans.	S4	.....	2	1 Lye O-235-C1	115	2800	.....	.....	.....	....	7	70	.....	65	....	800	10000[2]	15,000	200	1450	930	2.2	12.6	1	2	29′	22	390	2	5.5′	....	1525	.....	.....	.....
	S4A	YH-24	2	1 Lye O-290-D	130	2800	125	2600	SL	19.5	7	65	SL	60	SL	700	3500	7500	170	1500	950	2.3	12	1	2	29′	22	390	2	5′ 3″	....	1525	27′	10′	IP
Sikorsky Aircraft Division of United Aircraft Corp. Bridgeport 1, Conn.	S-51	H-5[3]	4	1 P&W R-985-B4	450	2300	450	2300	2600	100	28	103	SL	85	1000	1000	5000	14,500	276	5500	3810	2.92	12.22	1	3	49′	87.6	194	2	8′ 8″	6.16	1278	41′ 1.75″	12′ 11″	IP
	S-52	H-18	4	1 Fr 6V6-245-B16F	245	3275	245	3275	SL	60	16	111	SL	91	1000	1050	2600	13,000	306	2700	1825	3.16	11.02	1	3	33′	42.5	315	2	5′ 4″	2.32	2205	27′ 5″	8′ 8″	IP
	S-55	H-19	12	1 P&W R-1340 S1H2	600	2250	550	2200	8000	180	37	110	SL	86	1000	1130	9000	16,500	462	6800	4395	3.08	11.33	1	3	53′	108	194	2	8′ 8″	....	1360	41′ 8.5″	14′ 8″	IP

* — Approximate. † Estimated.
AHC — American Helicopter Co.
Con — Continental.
Fr — Franklin.
IP — In production.
Lye — Lycoming.
McD — McDonnell.

NP — Not in production.
P&W — Pratt & Whitney.
SL — Sea level.
UD — Under development.
Wr — Wright.
X — Experimental.

[1] 322-340.

[2] Without ground effect.
[3] Up to 25 troops or 5000 lb. of cargo carried in detachable pod.
[4] Commercial version (PD-22C) to carry 15 passengers and baggage or 21 passengers without baggage.

[5] Service ceiling.
[6] U. S. Navy designations of Sikorsky helicopters as follows: HO3S-1 (H-5); HO4S-1 (H-19); and HO5S-1 (H-18).
[7] Air Force H-23A, Navy HTE-1, similar to 360.

Among U. S. Helicopters . . .

Piasecki HUP-1

Sikorsky S-51

Bell XH-15

Bell H-12

Sikorsky H-19

Piasecki HRP-2

Sikorsky S-52

Hiller 360

Airlines Largest Factor in Airlift Potential

MATS is using about one-third of available fleet in Pacific Airlift.

By F. Lee Moore

The Pacific Airlift of today is about one-third our transocean transport potential. The present Pacific lift of 252 four-engine planes can make about 1000 round trips from the West Coast to Tokyo, hauling about 5000 tons payload a month.

Commercial airline transports make up the major part of our flexible airlift potential. The present Pacific lift has 172 military air transport service planes, 14 United Nations planes, and 66 U.S. airline transports.

That leaves still available a flexible airlift potential of modern four-engine MATS and allied commercial planes: About 450 U.S. commercial transports; about 225 foreign allied commercial transports; and about 200 MATS transports. The total of known four-engine planes available for more overseas transport comes to 865 (see table); probably at least 35 more are available, making the total reserve about 900 four-engine planes.

► **Twin-Engine Reserve**—In the U.S. alone, there are about 800 twin-engine commercial transports.

Almost all of these are needed at home to serve a mobilizing national economy and to do domestic and territorial military charter work. But among them are two groups readily available for military work in tactical areas anywhere in the world. These are the 78 C-46s of the certificated air freight carriers, and the 47 C-46s and 33 DC-3s of the large irregular domestic nonskeds.

These are the most flexible twin-engine reserve because they rely most on charters in peacetime. But, though available for military use, the certificated air freight outfits might better serve mobilization at home—carrying priority cargo between defense plants and between military bases, thereby conserving inventories and keeping the mobilization economy flexible.

As for the nonskeds, nobody yet knows what will become of their planes over the next two years. Perhaps the military will charter their services, as it has the international nonskeds, Seaboard & Western and Transocean. Or perhaps the domestic nonskeds will continue to sell their planes in the open market.

Airlines' Lift Potential

	4-ENGINED PLANES AVAILABLE					ON PACIFIC NOW
	Strato-Cruiser	DC-4	DC-6	Constel-lation	Total	No. of Planes
U. S.						
Panagra	..	4	6	20	30	1
PanAm	28	62	..	..	90	8
Northwest	10	18	..	..	28	4
TWA	..	14	..	55	69	5
American	..	13	49	..	62	6
Eastern	..	22	..	20	42	0
United	7	23	44	..	74	7
Braniff	..	9	6	..	15	0
Capital	..	25	..	5	30	2
C&S	..	3	..	3	6	0
Colonial	..	4	..	..	4	0
Delta	..	6	6	..	12	0
National	..	7	6	..	13	0
Western	..	5	..	..	5	1
Inland	..	1	..	..	1	0
Flying Tigers	..	5	..	..	5	7
Seaboard	..	5	..	..	5	7
Overseas	..	5	..	..	5	5
Cal Eastern	..	2	..	..	2	3
Alaska	..	3	..	..	3	3
Transocean	..	10	..	..	10	7
Others	..	15	..	..	15	0
TOTAL U. S.	**45**	**261**	**117**	**103**	**528**	**66**
FOREIG.						
BOAC	10	..	..	11	78**	0
KLM	..	10	6	18	34	0
Air France	..	30	..	16	46	0
Sabena	..	7	5	..	12	3
Can. Pac.	..	5	..	..	5	3
TCA	..	20	..	..	20	0
Scandinavian	..	9	14	..	23	0
CMA	..	6	1	..	7	0
OTAL	**10**	**87**	**26**	**45**	**225**	**6**

* Includes only large foreign fleets.
** BOAC Fleet includes 57 non-U. S. planes.
Source: CAA.

► **Transports On Order**—More than 270 new U. S.-type airliners already are on order for delivery the next 24 months. Half are the latest long-range four-engine planes—Constellations, Super-Constellations and DC-6Bs. The other half are the latest twin-engined designs—Martin 4-0-4s and Convair-Liner 340s.

This on-order fleet of about 135 four-engine and more than 135 twin-engine transports alone could move an airborne combat division between almost any two points in the world in one trip with but a few re-fueling stops. The four-engine half of the on-order fleet could take a division anywhere in the world in two round trips, or within less than two weeks.

That is the main reason the Defense Department and National Production Authority give airlines full Defense Order priorities for new planes. Almost all the new planes are for U.S. airlines. The remainder are mainly for such allied fleets as KLM Royal Dutch Airlines and Air France, which would make ideal airlift auxiliaries available for use in time of overseas war.

The civil transport fleet on order and the airline pilots and ground crews that go with it will actually make money for the U.S. taxpayer, rather than cost him money. The new planes, being more efficient than the older transports, will cut down airline costs per ton mile.

► **Lift Potential**—Based on normal passenger seating capacity per plane, the scheduled U.S. transport fleet alone has today a theoretical simultaneous lift potential of 41,558 passengers, compared with a mere 7745 passengers in 1941. Planes on order for delivery to U.S. airlines by 1952 add another 11,660 passenger-lift potential.

This tells only half the story. A plain Constellation or DC-6 because of of higher speed and efficiency, as well as seating capacity, can haul eight times the lift of a DC-3 over long distances. A Martin 2-0-2 or a Convair-Liner can triple the DC-3 lift. The new on-order fleet of Super-Constellations, DC-6Bs, Martin 4-0-4s, and Convair-Liner 340s is faster and bigger yet. So the number of planes is a most conservative measure of the U.S. growth in air transport lift potential. The planes on order now have

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Total Useful Airlift Potential

No. of Planes in Transport Use

COMMERCIAL	
U. S. Four-engine	
Stratocruiser	45
DC-6	117
Constellation	98
DC-4	254
TOTAL	514
Allied Airline Four-engine*	
Straticruiser	10
DC-6	26
Constellation	45
DC-4	87
British types	57
TOTAL	225
U. S. Twin-engine	
Convairliner	114
Martin 2-0-2	34
DC-3	505
Curtiss Commando	123
Miscellaneous	21
TOTAL	797
TOTAL COMMERCIAL LIFT	1536
MILITARY	
USAF-MATS planes	
C-54 (DC-4)	313
R5D (DC-4)	27
C-121 (Constellation)	10
C-74 (Globemaster I)	10
C-97 (Stratofreighter)	7
C-124 (Globemaster II)	2
XC-99	1
TOTAL MATS	370
Actual Pacific Airlift	
Air Force (MATS)	172
United Nations	14
U. S. Commercial transports	66
	252
FLEXIBLE AIRLIFT POTENTIAL LEFT	
U. S. Airline 4-engined	448
Allied Airline 4-engined	219
U. S. Airline 2-engined	797
USAF MATS 4-engined	198
TOTAL FLEXIBLE RESERVE	1662

* Larger airlines only.

NOTE: Flexible reserve includes U. S. and Allied Airline fleets, plus MATS Fleet, less the present Pacific Airlift. Flexible reserve here excludes small foreign airlines, an unknown number of allied military airlift planes, and the U. S. military close-support groups such as Troop Carrier Command, Strategic Support Squadrons, etc., which cannot be included in the available flexible reserve.

Sources: CAA.
MATS.

more combined lift potential than our entire fleet of 1946.

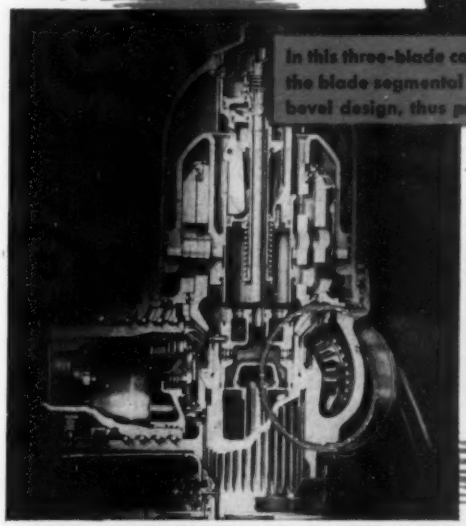
▶ **Industry Growth**—The air transport industry has the dynamic growth to keep up the rapid expansion planned. In 1940, domestic trunk lines flew one billion passenger miles. In 1950, they flew about eight billion passenger miles and 150 million ton miles of cargo, exclusive of mail.

In 1940, trunk airlines transported only 14 percent as many passenger miles as did first-class rail. Two years ago, the trunk airline figure was up to 71 percent; last year it was 84 percent. Normal trend would have the trunklines alone exceed first-class rail volume by 1955. American Airlines last year did more business than any railroad except the two giant commuter and

ACCURATE, DURABLE GROUND CURVED TOOTH GEARS

for AIRCRAFT

In present day aircraft, the demand for bevel gears to meet special requirements has greatly increased. In power operated control drives for retractable landing gear, bomb bay doors, rudders, ailerons, variable pitch propellors, aircraft engines and transmissions and rotors for helicopters; Zerol bevel and spiral bevel gears, ground on a Gleason Spiral Bevel and Hypoid Grinder, have proven through actual service that the smooth fillet radius obtained permits longer operation under heavier loads. Increased accuracy, made possible through grinding, to remove hardening distortion has permitted operation at speeds greater than previously considered practicable.



In this three-blade controllable pitch propeller, the teeth of the blade segmental gears and rotating cam are of ZEROL bevel design, thus providing smooth, accurate operation.

In the helicopter field ground spiral bevel gears are used in 90° and 45° tail rotor drives and in the transmission between the motor and the elevating rotor. These ground gears are depended upon for both speed and power and greatly contribute to the successful specialized service helicopters perform for aviation.

Grinding gears on the Gleason No. 27 Hypoid Grinder assures:

1. Highest precision and true interchangeability at mass production rates. Gears will be uniform for tooth size, tooth bearing and surface finish for the automatic cycle eliminates the variable human element.
2. An elimination of major causes of spoilage, operator's errors and omissions.

   With automatic cycle control, the operator cannot fail to follow the prescribed grinding sequence for every gear.
3. Ease of operation to simplify grinding of gears at production rates. Once machine is set up, operator has only to change work and push the start button.

GLEASON Works
1000 University Avenue
Rochester 3, N.Y., U.S.A.

Builders of Bevel Gear Machinery for Over 85 Years

stays on the job at temperatures up to 1200° F

That's good news, when you add it to the established fact that BOOTS self-locking, all-metal, one-piece construction:

RESISTS VIBRATION ***with a positive force through a unique locking principle. HEX-LOK provides fastening and locking surfaces integrated in one structural unit.***

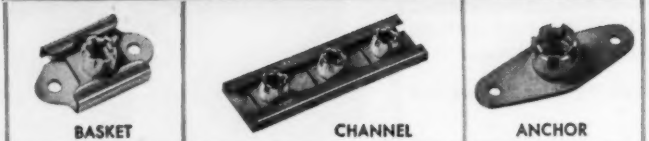
RESISTS STRUCTURAL BREAKDOWN ***due to frequent, radical temperature changes.***

HEX-LOK is available in all popular sizes. When you need high torque retention, high reusability, simplified maintenance, less weight, INSIST on the BOOTS HEX-LOK!

HEX-LOK is satisfying a wide variety of applications for aircraft engines and airframes at temperatures up to 1200° F.

Inquire about the complete line of BOOTS self-locking nuts.

PLATE-LOK TYPES AVAILABLE:



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BOOTS Aircraft Nut Corporation
STAMFORD, CONNECTICUT

long-haul systems—New York Central and Pennsylvania.

Even if rail coach is considered, the airlines are replacing the railroad passenger market. Domestic trunk airlines in 1940 flew 5 percent as many passenger miles as all rail travel. Now the trunklines alone are transporting almost one-third as many passenger miles as the railroads with rail coach and first-class together.

Room for further growth at a strong rate is shown by several facts: air travel would more than double by merely taking over most first-class rail travelers; comparative ease and speed or air compared to rail travel creates a new market; and air travel fares are steadily going down compared to rail fares.

Barring full mobilization and war, air coach travel may accelerate the trends—rail fares up and air fares down. Temporarily, the average domestic air travel fare is now stabilized at around 5¾ cents a mile. This is because the rising costs and heavy business demand going with mobilization recently reversed the trend toward cheaper services and air coach.

The 12 months ended Sept. 30, 1950 saw a temporary low of average domestic air fares at 5.57 cents a mile, compared with 5.76 cents for the calendar year 1949. In November, 1950 CAB raised coach fares from 4 cents to 4½ cents a mile. If mobilization continues, average fares may rise further, as promotional fares become needless. But while rail fares trend continually up, air fares are still in a downtrend over the long term. As soon as war mobilization effects dwindle, average air fares will probably go down fast bringing increased business volume.

▶ **Safety and Reliability**—Besides lower fares and greater convenience, air transport growth has two more drawing cards that will reap more business for the airlines—greater safety and greater schedule reliability. Safety statistics show airline travel getting safer year by year. In 1950 a passenger fatality occurred only once in 85 million scheduled passenger miles—the best domestic safety record yet.

Schedule reliability this winter is better than ever, with most airlines completing 95-99 percent of scheduled flights. United Air Lines, particularly affected by seasonal weather on its routes, has shown a gain in schedule reliability every winter since the war.

Electronics development holds the key to near-100-percent reliability by 1955. Just being introduced to routine airline operations, under guidance of the Air Navigation Development Board, are: improved ILS, more precision approach radar; automatic approach by autopilot; improved high intensity approach lights; radar traffic control;

(*Continued on page* 101)

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PROFITS — Indispensable

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SIOUX Valve Cleaner

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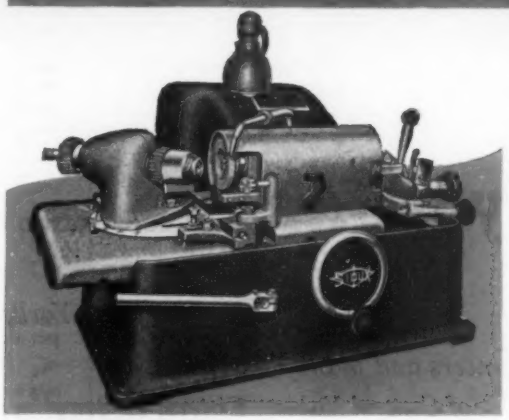

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of Control Valves, Filters, Hydraulic,
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U. S. Civil and Military Transport Aircraft

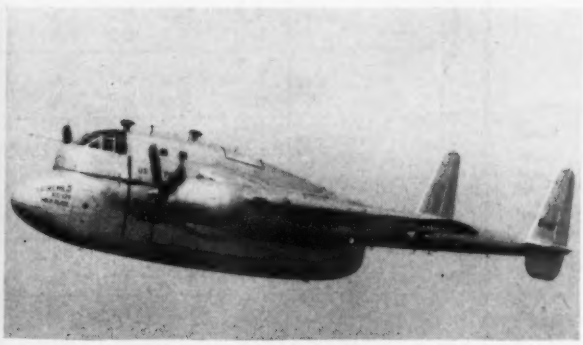
Manufacturer and Address	Designation	Name	Number of crew	Number of passengers	Cargo Capacity: Cubic feet	Cargo Capacity: Pounds	Powerplant: Number, make and model	Powerplant: Takeoff hp. (SL)	Powerplant: At rpm.	Powerplant: Normal rated hp.	Powerplant: At rpm.	Powerplant: At altitude (ft.)	Performance: Cruising speed (mph.)	Performance: At altitude (ft.)	Performance: Takeoff distance (SL), no wind at gross wt. over 50ft. obstacle	Performance: Landing distance over 50 ft. obstacle	Performance: Sea level climb at gross wt. (fpm.)	Performance: Sea level climb at gross wt. with one engine dead (fpm.)	Performance: Normal fuel capacity (gal.)	Performance: Normal range (mi.)	Performance: Direct operating cost (cents/pass. mi.; cents/ton mi.)	Weights: Gross weight (lb.)	Weights: Empty weight (lb.)	Weights: Useful load (lb.)	Dimensions: Span	Dimensions: Length	Dimensions: Wing area (incl. ailerons)
Beech Aircraft Corp.	D18S	Twin Beech	2	6	.....	900	2 P&W R-985 AN14B	450	2300	400	2200	5000	211	10,000	1760	1460	1190	225	206	1120	.....	8750	5770	1750	47′ 7″	33′ 11.5″	349
E. Central Ave.	50	Twin Bonanza	1-2	4-5	55	300	2 Lyc GO-435-C2	260	3400	240	3000	SL	190+	10,000	1346	1213	1500	465[1]	135	1255	.....	5500	3763	.....	45′ 4″	31′ 6.5″	277
Wichita, Kans.																											
Boeing Airplane Co.	377	Stratocruiser	3-5	55-80	845	.....	4 P&W R-4360 TSB3-G	3250[2]	2700	1900[3]	2300	.....	300[4]	25,000	6250[5]	3470[7]	1100	335[8]	7790	.....	.....	142,500	83,500	.....	141′ 3″	110′ 4″	1769
Seattle 14, Washington	C-97A	Stratofreighter	5	79-130	.....	.....	4 P&W R-4360-35	3500	....	2650	2700	.....	300+	.....	.....	.....	.....	.....	7790	3750	.....	148,000	.....	.....	141′ 3″	110′ 4″	1769
Chase Aircraft Co., Inc.	YC-122C	Avitruc	2	30	1560	.....	2 Wr R-1820-101	1425	2700	1275	2500	3000	200	.....	1150	900	1340	.....	.....	2900	.....	32,000	19,000	13,000	95′ 8″	61′ 8″	812.8
W. Trenton, N. J.	XC-123	Avitruc	2	60	3750	.....	2 P&W R-2800CB-15	2500	2800	1900	2600	7000	205	.....	1180	930	1250	.....	1340	2110	.....	49,000	26,800	22,200	110′	77′ 1″	1223.22
Consolidated Vultee Aircraft Corp.	240	Convair-Liner	3-4	40	329	.....	2 P&W R-2800CA-18	2400	2800	1800	2600	6000	272	16,000	2760	2355	1520	.....	1550	1150	.....	41,790	27,682	14,108	91′ 9″	74′ 8″	817
3302 Pacific Highway	.....	Turboliner[10]	...	...	.....	.....	2 All 501-A2	2750	....	.....	....	.....	310	16,000	2150	.....	1940	.....	1550	.....	.....	41,790	.....	.....	91′ 9″	74′ 8″	817
San Diego, Calif.																											
Douglas Aircraft Co., Inc.	Super DC-3-1189A		3	31	282	.....	2 Wr R-1820-C9HE[11]	1475	2800	1275	2500	3500	251	15,400	2510	2490	1300	280	.....	1425	.95/pass.	31,000	19,537	.....	90′	67′ 8″	.....
3000 Ocean Park Blvd.	R4D-8 (1192)		3	35	.....	12,900	2 Wr 968C9HE1	1475	2800	1275	2500	3500	254	15,900	2330	1560	1350	270	1625	2970	.....	31,000	19,500	11,500	90′	67′ 8″	967
Santa Monica, Calif.	DC-6A-1135 Liftmaster		3	.....	5000	30,000	4 P&W R-2800CB-16	2400	2800	1600	2600	16,000	311	20,600	3950	3010	1010	520	3322[12]	3560	5.7/ton	100,000	49,767	50,233	117′ 6″	105.6′	1463
	R6D-1 (1134A)		5	.....	5000	.....	4 P&W R-2800CB-17	2500	2800	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	117′ 6″	107′	1463
	C-118A (1250)		5	.....	5000	.....	4 P&W R-2800CB-17	2500	2800	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	117′ 6″	107′	1463
	DC-6B-1198		5	52-66	970	12,730	4 P&W R-2800CB-16	2400	2800	1800	2600	8500	311	20,600	3950	3010	1010	520	3322	3560	.90/pass.	100,000	54,148	45,852	117′ 6″	105.6′	1463
	DC-6B-1225[14]		7	52	539	7610	4 P&W R-2800CB-17	2500	2800	1900	2600	7000	316	23,100	4100	3010	1090	560	5380	4010	1.3/pass.	103,000	56,820	46,180	117′ 6″	105.6′	1463
	C-124A	Globemaster 2	5	200	10,400	50,000	4 P&W R-4360-20W	3500	2700	2650	2550	7500	.....	.....	.....	.....	.....	.....	11,100	2300[15]	.....	175,000	95,707	79,293	173′ 3″	127′ 2″	2510
	YC-124B	Globemaster	5*	200*	10,400*	.....	4 P&W YT34-P-1	5500	....	.....	....	.....	.....	.....	3250[16]	2070	....	.....	.....	.....	.....	200,000*	.....	.....	173′*	127′*	2500*
Fairchild E&A Corp.	C-82A	Packet	5	41*	2312	.....	2 P&W R-2800-85	2100	2800	1700	2600	7300	.....	.....	.....	.....	800	.....	2614	.....	.....	54,000	31,288	.....	106.5′	77.08′	1400
Aircraft division	C-119B	Packet	5	42-78	2700	.....	2 P&W R-4360-20W	3250	2700	2650	2550	6000	.....	.....	2520	1355[18]	1130	.....	2624	.....	.....	64,000	38,012	.....	109′ 3″	85′ 10″	1447
Hagerstown, Md.	XC-120	Pack Plane	5	44-64	2760	20,000*	2 P&W R-4360-20	3250	....	.....	....	.....	.....	.....	.....	.....	1100	.....	2798	.....	.....	64,000	38,174	20,000	109′ 3″	83′	1447*
Lockheed Aircraft Corp.	L-049	Constellation	6	51	445	.....	4 Wr R-3350-BA	2500	2800	2000	2400	4800	306	20,000	3120	2315	1500	850	4690	3100	.....	96,000	58,000	.....	123′	95′ 2″	1650
Burbank, Calif.	L-749A	Constellation	6	57	434	.....	4 Wr R-3350-BD1	2500	2800	2100	2400	4400	327	23,000	3680	2880	1195	630	5820	3200	.....	107,000	64,800	.....	123′	95′ 2″	1650
	L-1049	Constellation	6	77	715	.....	4 Wr 956C18CA1	2700	2900	2300	2600	6200	304	21,500	4740	3150	1188	598	6570	3300	.....	120,000	70,000	.....	123′	113′ 7″	1650
	L-1049C	Constellation	6	77	715	.....	4 Wr 972TC18DA1	3250	2900	2650	2600	6500	341	22,600	4030	3410	1270	660	6570	3950	.....	130,000	74,000	.....	123′	113′ 7″	1650
	XR6O-1	Constitution	12	168	7375	.....	4 P&W R-4360-22W	3500	2700	2650	2550	23,500	240	.....	4320	2301	722	.....	10,000	2800	.....	184,000	119,715	65,285	189′ 1″	156′ 1″	3610
Glenn L. Martin Co.	2-0-2	.....	3	36	346	.....	2 P&W R-2800-CB-16	2400	2800	1800	2600	8500	286	12,000	3740[17]	2320[18]	1790	460	.....	1380[19]	.....	42,750	26,211	.....	93′ 3″	71′ 4″	.....
Baltimore 3, Md.	2-0-2A	.....	3	36	275	.....	.....	.....	....	.....	....	.....	270	18,000	1880	1720	1885	382	1350	1135	.....	43,000	27,064	.....	93′ 3″	71′ 4″	864
	4-0-4	.....	3	40	344	.....	2 P&W R-2800CB-16	2400	2800	1800	2600	8500	280	18,000	1780	1670	1790	460	1350	805	.....	42,750	29,402	14,665	93′ 3″	74′ 7″	905.8

* — Approximate.
All — Allison.
AP — Aeroproducts.
B — Beech.
C — Curtiss.
HS — Hamilton Standard.
Lyc — Lycoming.
P&W — Pratt & Whitney.
SL — Sea level.

Wr — Wright.
[1] Full-feathering propeller.
[2] Takeoff power, dry. With water injection, power is 3500 at 2700 rpm.
[3] Maximum cruise power. Maximum continuous power is 2800 at 2550 rpm.
[4] 300-340 mph.
[5] CAR field length at 142,500 lb.
[7] CAR field length at 110,000 lb. using four reverse props.
[8] Rate of climb on two engines at maximum continuous power at 110,000 lb.
[10] Civil cargo plane testbed for turboprop engines built to the order of Allison division of General Motors.
[11] Or P&W R-2000 engines.
[12] To 4700 gal.
[14] Overwater airplane.
[15] Maximum range is 5460 mi.
[16] At 145,000 lb. gross weight.
[17] Based on requirements for CAR 4b.
[18] With reversible props.
[19] 36 passengers and 1000 lb. of cargo.

Among U. S. Transport Planes . . .

Douglas C-124 Globemaster



Fairchild XC-120

Lockheed Constellation

Douglas DC-6B

Consolidated Vultee Turboliner

Douglas Super DC-3

Consolidated Vultee Convair-Liner

Martin 4-0-4

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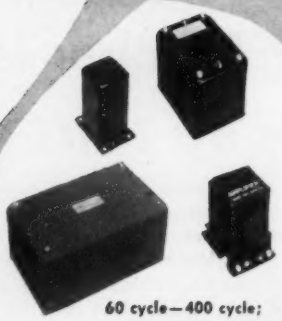

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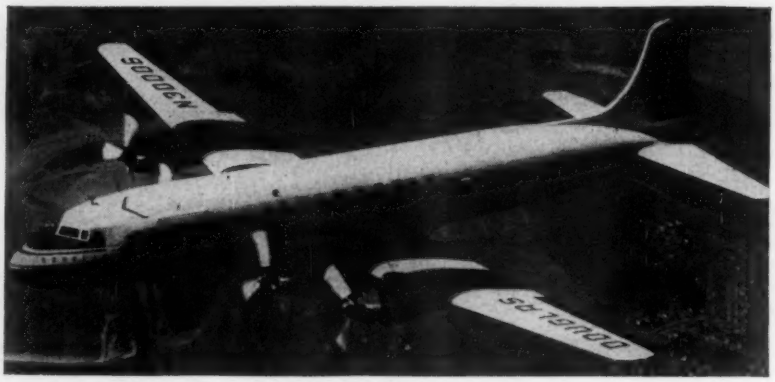
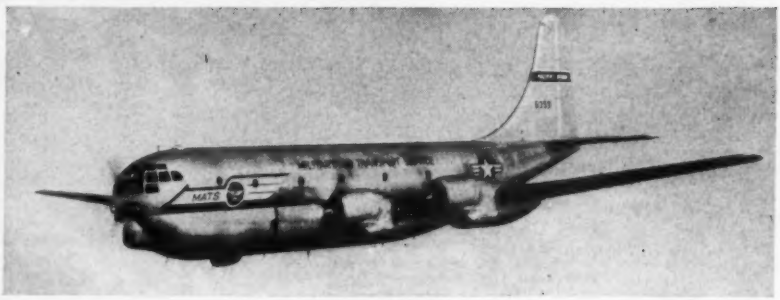
Among U. S. Transport Planes . . .

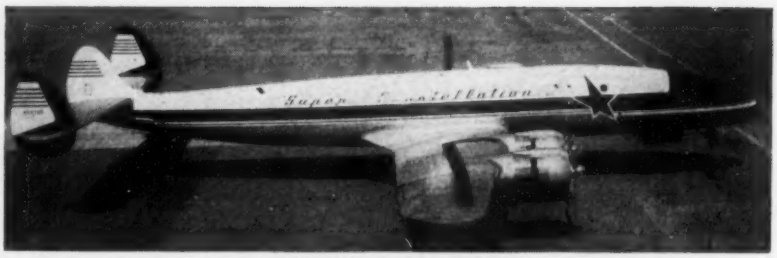


Douglas DC-6A Liftmaster

Chase C-123



Boeing C-97A



Lockheed Super Constellation

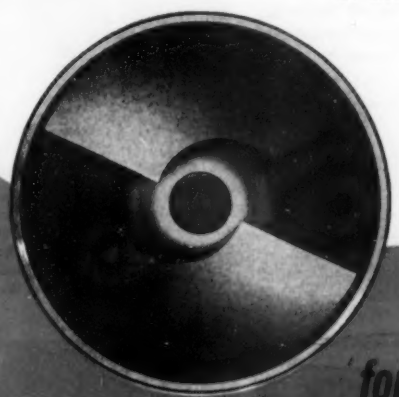
Fairchild C-119 Packet

Commercial transport planes of every aircraft builder in the United States are equipped with

DYNAMIC AIR BLOWERS

. . . used for recirculation of hot and cold cabin air; defogging of windshields and astrodomes; destratification in critical areas; cooling of electronic equipment, generators, alternators, voltag regulators; air sampling for fire control and thermostatic control; man-cooling and ventilation.

In 1942 Dynamic Air Engineering, Inc., designed and perfected the FIRST AXIAL FLOW BLOWERS for use as airborne equipment, and between 1942 and 1945 manufactured more than 50,000 axial flow blowers installed on military aircraft. Since 1942, this organization has been on that job to the exclusion of all other types of blower equipment, and with accumulated engineering time of over 160,000 hours.



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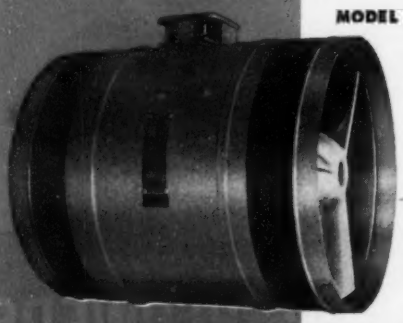
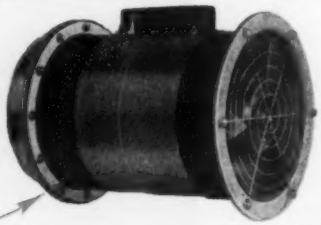


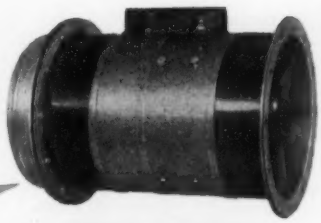
MODEL #M142A-6A
(2 stage.) 27 volt DC. Boeing 377 Stratocruiser main cabin recirculation. 3,700 CFM at 4" Static Pressure. Diameter 14". Weight 45 lbs. Duty continuous.

MODEL #M141C-1A
(1 stage.) 27 volt DC. Boeing 377 Stratocruiser condenser cooler, 2 per airplane. 3,700 CFM at 4" Total Head Pressure. Diameter 14". Totally Explosion Proof. Wt. 49 lbs.

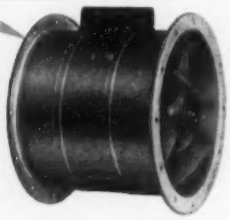
MODEL #M8862B-8B
(2 stage.) 27 volt DC. Constellation main cabin recirculation. 2 per airplane. 1,300 CFM at 8" Static Pressure. Diameter 9". Pressure tight to 7 PSI. Wt. 35 lbs.

MODEL #M8862F-9A
(2 stage.) 27 volt DC. Special modification of M8862B-8B. Performance identical. Martin 202 Airliner ground heating and cooling. Diameter 9". Wt. 35 lbs.





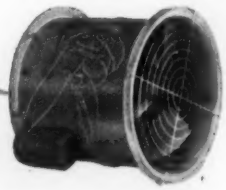
MODEL #M8921A-1A
(1 stage.) 27 volt DC. Special adaptation from M8862B-8B for Navy P2V airplane. 1,200 CFM at 6" Static Pressure. Diameter 9" Wt. 21 lbs. Other information restricted.



MODEL #M8922A-9A
(2 stage.) 27 volt DC. Special modification of M8862B-8B. 1,785 CFM at 8" or 1,560 CFM at 10" Static Pressure. American Airlines CV 240 cooling of refrigeration aftercooler. Diameter 9". Wt. 36 lbs.

MODEL #M7861K-1B (1 stage.) 115 volt, 60 cps, AC. Used by several Electronics Mfrs. for tube cooling. 450 CFM at .5" Static Pressure. Diameter 8". Wt. 9 lbs.

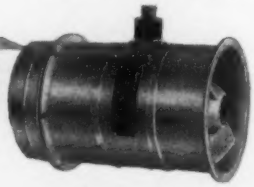
MODEL #M7861N-2A
(1 stage.) 115 volt, 60 cps, AC. Identical to M7861K-1B except for configuration.



MODEL #M6862CL-1A
(2 stage.) 27 volt DC. Designed for Martin modified DC-4 airplanes in use by Eastern Airlines, Capital Airlines, Braniff, C&S and others. Main cabin ground heating and ventilation. 690 CFM at 5" Static Pressure. Dia. 7". Wt. 11½ lbs

MODEL #M6862A-6A
(2 stage.) 27 volt DC. Modified for higher performance for TWA Boeing 307 and Peruvian Airways and others on C-54 modifications. Ground heating recirculation and cooling. 900 CFM at 6" Static Pressure. Dia. 7" Wt. 19 lbs.

MODEL #M6862G-9A
(2 stage.) 27 volt DC. Modified M6862CL-1A for Midcontinent Airlines and others for use on CV 240 airplane, maincabin heat. and vent. 800 CFM at 4" Static Pressure. Dia. 7" Wt. 15 lbs.

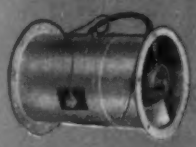


Pictures shown here are actual photographs of only a portion of the active models available and are intended to show the numerous configurations available. All data subject to change without notice.

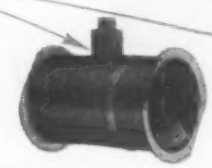
In many instances the modification of an active, proven model to suit your particular application problem will save days, weeks or even months of time. It will also remove most of the uncertainties which enter into a new installation. Proven performance with dependability and low maintenance cost is something more than expectancy or a promise — it is already shaken down — *it is*.
More than 100 models of D.A.E. Inc. blowers are in service today on current aircraft. They represent 10 basic models with 90 modifications to meet particular needs or specifications. A few examples of "originals" and modifications are shown here. Modifications to suit your needs are available.

MODEL #M5862X-9A
(2 stage.) 27 volt DC. Pan American Constellation 049 main cabin recirculation. 450 CFM at 7" Static Pressure. Dia. 6". Wt. 10 lbs.

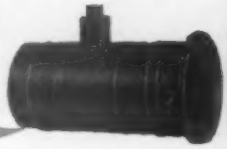
MODEL #M5861AD-8A
(1 stage.) 27 volt DC. Stewart-Warner USAF Glider Packaged Heater Unit. 340 CFM at 5" Static Pressure. Dia. 6". Wt. 7¼ lbs.



MODEL #M4862K-1C
(2 stage.) 208 volt AC, 400 cps, 3 phase. B-36 airplane heat. & vent. system, 4 per airplane. 200 CFM at 2½" Static Pressure. Dia. 5". Wt. 5½" lbs.

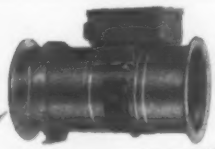


MODEL #M4862J-6B1
(2 stage.) 27 volt DC. 377 Stratocruiser Empenage de-icing recirculation. 325 CFM at 4" Static Pressure. Dia. 5". Wt. 6¼ lbs.

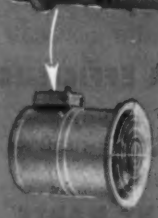


MODEL #M4862L-1B1
(2 stage.) 27 volt DC. DC-6 airplane voltage regulator cooler, 2 per airplane. 275 CFM at 5½" Static Pressure. Dia. 5". Wt. 6.3 lbs.

MODEL #M4582AD-2A
(2 stage.) 27 volt DC. NAA B-45 airplane heating system and ground ventilation. 225 CFM at 6" Static Pressure. Dia. 4.75" Wt. 9 lbs.



MODEL #M4582B-6A
(2 stage.) 27 volt DC. Constellation 649, 749 & 1049 flt. deck booster, heat. & vent. 300 CFM at 4" Static Pressure. Dia. 4.75". Wt. 8.75 lbs.

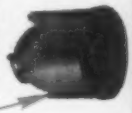


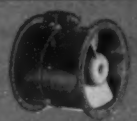
MODEL #M4581A-3A
(1 stage.) 27 volt DC. & 400 cps AC. Constellation 649 and 749 defoggers. Westinghouse and General Electric and others for electronic tube cooling. This blower also made for 400 cps AC current. 145 CFM at 1.5" Static Pressure. Dia. 4.75". Wt. 4.2 lbs.

MODEL #M4582B-1C1
(2 stage.) 27 volt DC. 377 Stratocruiser generator cooling. 4 per airplane. 275 CFM at 5" Static Pressure. Dia. 4.75". Wt. 8.75 lbs.

MODEL #M4581A-2B
(1 stage.) 27 volt DC. & 400 cps AC. Same as M4581A-3A except for housing configueration.

MODEL #M4581A-2BA
(1 stage.) 27 volt DC. Special modification of housing for Westinghouse Electronics. Otherwise same as M4581A-2B.





MODEL #M4381B-1B
(1 stage.) 27 volt DC. & 400 cps AC. Westinghouse and Bendix electronic cooling, several models. 110 CFM at .4" Static Pressure. Dia. 4½". Wt. 1.75 lbs.

MODEL #M4381B-1C
(1 stage.) 27 volt DC. & 400 cps AC. Modification of M4381B-1B to plastic special shape housing. 90 CFM at 4" Static Pressure. Dia. 4½" Wt. 1.40 lbs.

MODEL #M2881A-1
(1 stage.) 27 volt DC. & 400 cps AC .Used on numerous electronic installations for tube cooling. 60 CFM unrestricted. 36 CFM at .80" S.P. Dia. 3" Wt. 1¼ lbs.

MODEL #M2881A-2A
(1 stage.) 27 volt DC., cps & 400 cps AC. This model can be modified with several types of housing and for several types of current. It can also be built in "two-stage" to double the pressure characteristic. 1 stage performance 60 CFM at .2" or 35 CFM at .8". Dia. 3". Wt. 1¼ to 2 lbs. depending on modification.

MODEL #M2881F-3
(1 stage.) 27 volt DC. permanent magnet motor. 60 CFM at .2" or 30 CFM at .5" S.P. Dia. 3". Wt. 8 oz.

MODEL #M2881F-8A
(1 stage.) Same as other M2881 units. Shown here for type of housing.

MODEL #M1921N-1
(1 stage.) 27 volt DC. or 400 cps AC. 32 CFM at .2" or 20 CFM at .5" S.P. Dia. 2". Wt. 7½ oz.

MODEL #M1921N-1A
Same as M1921N-1 except housing.

These small 2" diameter blowers can be made in any of a number of housing configurations to suit tight space limitations.

DYNAMIC AIR ENGINEERING Inc.

LOS ANGELES, U. S. A.

— means axial flow and vanaxial flow blowers with

BLOWER DEPENDABILITY

LOW MAINTENANCE COST

HIGH PERFORMANCE EFFICIENCIES

LOW WEIGHT PENALTIES

PROMPT SERVICE ON COMPONENT PARTS

COMPETENT ENGINEERING "KNOW HOW"

WARRANTIES WITH A MEANING

So say our customers:

COMMERCIAL AIRLINES

A B Aerotransport
Air France
All-American Airways
American Airlines
Braniff Airways
British Overseas Airways
Capital Airlines
Chicago and Southern Air Lines
China National Airlines
Continental Air Lines
Delta Air Lines
Eastern Air Lines
KLM (Royal Dutch Airlines)
Mid-Continent Airlines
National Airlines
Northeast Airlines
Northwest Airlines
Pan American World Airways
Philippine Air Lines
Sabena
Swissair
TATA Air India
Trans-Australia Airlines
Trans-Canada Airlines
TWA
United Airlines
Western Air Lines

AIRPLANE MANUFACTURERS

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Hughes Aircraft Co.
Lockheed Aircraft Corp.
McDonnell Aircraft Corp.
North American Aviation
Republic Aviation Corp.
Texas Engr. & Mfg. Co.

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Airborne Instrument Laboratories
Barber & Williamson Co.
Bendix Radio Division
Bird Electronic Corp.
Collins Radio
Espey Mfg. Co.
Gilfillan Bros.
General Electric Electronic D.
Heil Co.
Houston Corp.
Lycoming-Spencer, Div. AVCO
M.I.T. Experimental Dept.
Nashville Corp., Div. AVCO
Philco Corp.
Raytheon Mfg. Co.
Reeves Instrument Co.
Sperry Gyroscope Co.
Stewart-Warner, Southwind Div.
Surface Combustion Corp.
Westinghouse Electric & Mfg. Co

New U. S. Transport Delivery Schedule

	Total	Maker	Type	1951											1952											1953	
				F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
U. S. Airlines																											
American	11	Douglas	DC-6B	1	2	2	2	3	1																		
Braniff	3	Douglas	DC-6B							1	1	1															
Braniff	20*	Convair	340																								
C & S	3	Lockheed	749		1	1		1																			
Continental	8*	Convair	340																								
Eastern	14	Lockheed	1049									1	2	3	4	3	1										
Eastern	35	Martin	404					1	1	2	2		8	8	8	5											
Pan American	18	Douglas	DC-6B									1	2	1	1	2	2	2	2	2	2	1					
Panagra	2	Douglas	DC-6B											1	1												
Slick	3	Douglas	DC-6A	1							1			1													
Trans World	8	Lockheed	749	2		1	2	2		1																	
Trans World	10	Lockheed	1049												1	2	4	3									
Trans World	41	Martin	404			2	3	4	5	2	6	8				3	8										
United	20	Douglas	DC-6B	2	1	2	1		1	1							2	4	1	5							
United	30*	Convair	340																								
TOTAL U. S.	226																										
Foreign																											
Air France	4	Lockheed	749						1	2	1																
Air India	2	Lockheed	749			1	1																				
Avianca	2	Lockheed	749			1	1																				
KLM	7	Douglas	DC-6B												1	2	1	2	1								
KLM	1	Lockheed	749	1																							
KLM	9	Lockheed	1049																					2	2	2	2	1
Philippine	2	Douglas	DC-6B														1	1									
Scandinavian	2	Douglas	DC-6B												1	1											
Swiss Air	2	Douglas	DC-6B					1	1																		
TOTAL FOREIGN	31																										
OTHER																											
Aramco	2	Douglas	DC-6B														1			1							
Aramco	2*	Convair	340																								
The Texas Co.	1*	Convair	340																								
TOTAL OTHER	5																										
GRAND TOTAL	262																										

* Delivery dates not scheduled.
Source: Aircraft Industries Assn. and individual manufacturers.

VOR and other navigation aids; and many other improvements.

►**No Radical Changes**—The way new equipment programs are shaping up, it looks as if there will be no radical changes in air transport before at least 1955. Slow, evolutionary development with the safety element first is the trend.

Planes on order are larger, faster but conventional. The prototype testing bill providing $12.5 million for testing advance-type transports can only do two things today; refine present types and outline broad specifications for tomorrow's planes.

The Prototype Advisory Committee is sitting with $12.5 million to spend, but almost no practical way to spend it. Plans are: pretend a B-45 jet bomber is a jet transport and see how it operates on a hypothetical scheduled transport run; test the Allison Turboliner and the turboprop version of the C-124 Globemaster when they become available a year or more from now; draw detailed specifications for the short-haul transport of 1955-60.

The committee may someday test British and Canadian jet transports available now, but this would appear impolite for the American Committee. It might also test a 10-passenger helicopter for possible application to feeder airline use.

Meanwhile, war mobilization is taking the full time of the aircraft industry engineering and sales divisions.

So conventional transports are here to stay for many years to come. Outlook for transport development under present circumstances is toward slow but steady improvement in operational efficiency, schedule reliability, and safety. The industry has been burned too often by jumping into new-type aircraft when first offered.

Probably the most sensational improvement due in the next several years is in schedule reliability because of use

Growth of U. S. Scheduled Transport Fleet*

(Planes and Seats Available)

1950			1949		
No.	Planes	Seats	No.	Planes	Seats
388	Douglas DC-3	9,312	452	Douglas DC-3	9,492
3	Super DC-3	96	233	DC-4	11,650
220	DC-4	11,000	110	DC-6	5,500
117	DC-6	7,020	5	Boeing 307	190
5	Boeing 307	190	41	Stratocruiser	2,460
45	377	2,700	24	Martin 2-0-2	960
31	Martin 202	1,116	113	Convair 240	4,520
119	Convair 240	4,760	44	Lockheed L-49	2,200
54	Lockheed L-49	2,700	13	L-649	650
3	L-649	150	23	L-749	1,150
46	L-749	2,300	11	Lodestar	154
11	18	154	6	Electra 10A	60
6	10A	60			
1,048		41,558	1,075		38,986

1948			1941		
No.	Planes	Seats	No.	Planes	Seats
470	Douglas DC-3	9,870	16	Douglas DC-2	224
201	DC-4	10,050	255	DC-3	5,379
4	Boeing 247-D	40	45	DST	945
8	307	280	28	Boeing 247-D	280
40	Lockheed L-49	2,000	8	307	255
12	Lodestar	168	16	Lockheed Lodestar	224
1	Beech D-18C	8	19	Electra 10A	190
			6	Sikorsky S-42	192
			4	S-43	56
736		22,416	378		7,745

* Certificated Alaskan carriers included. Certificated all-cargo carriers (Slick, Flying Tigers, U. S. Airlines) excluded.
Figures shown are as of December of each year.

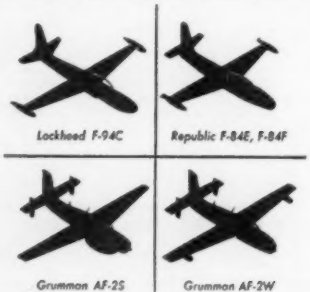
The ROTORette approaches the ultimate in simplicity for a two-position rotary actuator because of its unique load-sensitive feature.

Motion is controlled *positively* by adjustable mechanical limit stops. The adjustable load-sensitive limit switches are de-energized whenever the actuator either reaches the limits of mechanical travel or encounters the maximum permissible load. This construction provides two essential characteristics for dependable operation of valves, dampers, etc., up to 50 inch-pounds maximum operating load:

1. Accurate positioning of the driven device
2. Elimination of damage from overtravel or overload

See condensed literature in 1951 I.A.S. Aeronautical Engineering Catalog or write for Bulletin 118.

ROTORette
is currently used on these planes



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ACCESSORIES CORPORATION
Note our new address ➧ 1414 Chestnut Avenue Hillside 5, New Jersey
LOS ANGELES, CALIFORNIA • DALLAS, TEXAS • OTTAWA, CANADA

Large Irregular Carriers' Equipment

(July 1, 1949 to June 30, 1950)

Carrier	Passengers Transported	Passenger Miles	Cargo Tons	Ton Miles	Type of Aircraft Owned*
Aero Finance	1,950	6,180,977	.....	.....	1 C-46
Air Cargo Express	2,508	3,372,517	.....	.....	3 DC-4
Air Services	730	777,587	.....	.....	1 C-46
Air Transport Associates	7,694	11,644,732	765	1,202,120	4 C-46
Airline Transportation	3,057	8,848,783	.....	.....	3 DC-3, 1 DC-4
All-American	187	184,174	1	1,712	1 C-46
American Air Transport	13,116	13,660,190	.....	.....	1 DC-3, 2 C-47
American Flyers	1,015	1,140,184	.....	.....	4 DC-3
Argonaut	657	1,468,114	10	9,644	1 C-46, 1 DC-3
Arnold Air Service	3,786	6,406,368	173	278,673	1 C-46
Arrow Airways	12,680	21,793,408	.....	.....	1 C-46
Arctic Pacific	902	1,502,150	518	866,515	2 C-46
Associated Air	1,204	1,834,344	.....	.....	1 C-46
Aviation Corp. of Seattle	8,593	12,528,322	113	42,553	3 C-46
Blats	4,097	2,630,300	.....	.....	1 DC-3
Capital Airways	1,182	2,525,797	.....	.....	1 DC-3
Continental Charters	7,689	13,101,066	574	579,857	3 C-46
Freight Air, Inc.	2,877	2,221,476	.....	.....	1 C-46
General Airways	1,433	1,292,508	511	271,378	1 C-46, 2 DC-3
Golden North	2,977	1,752,208	181	296,840	1 C-46
Great Lakes	11,725	21,403,926	.....	.....	1 DC-4
Hemisphere	18	21,600	.....	.....	.....
Johnson Flying	116	14,667	.....	.....	2 C-47
Los Angeles Air	2,485	1,996,270	.....	.....	1 DC-3, 2 DC-4
Meteor	1,649	655,896	.....	.....	1 C-46, 2 DC-3
Miami Airlines	9,215	15,577,895	685	1,413,323	4 C-46
Missouri Airways	370	26,698	.....	.....	1 DC-3
Modern Air Transport	16,166	19,870,948	.....	.....	2 DC-4, 1 Boeing
Monarch	3,327	3,474,504	.....	.....	3 DC-3
Nationwide	12,487	13,527,421	.....	.....	7 C-46
New England	13,578	22,081,028	.....	.....	2 C-46
Ocean Air	1,891	3,086,212	.....	.....	4 DC-4
Overseas National	473	10,075,373	.....	.....	5 DC-4
Oxnard	26,003	40,204,848	.....	.....	3 DC-4, 2 DC-3 1 C-46
Pearson-Alaska	765	317,842	.....	.....	1 C-47, 1 DC-4
Peninsular	11,914	14,376,663	.....	.....	3 C-46, 1 C-47
Quaker City	226	176,058	.....	.....	1 DC-3
Robin	7,320	6,427,734	.....	.....	1 DC-3, 1 C-46
Royal	166	309,487	.....	.....	1 DC-4
Scott (U. S. Aircoach)	1,290	3,197,073	.....	.....	5 DC-4
Seaboard & Western	4,867	18,565,426	1,032	3,964,244	2 DC-4
Standard Air Cargo	2,660	4,906,642	27	13,742	1 C-46
Stewart	327	346,592	.....	.....	2 DC-3
Trans-American	9,788	15,592,191	.....	.....	1 C-46
Trans-Caribbean	14,220	28,737,700	53	123,509	2 C-46, 1 DC-4
Trans-National	292	638,577	.....	.....	1 DC-3
Trans-Ocean	33,729	75,181,577	.....	.....	6 DC-4
Viking	18,300	51,212,710	.....	.....	.....
World Airways	4,381	9,598,395	.....	.....	2 C-46
TOTALS	**288,082**	**496,467,158**	**4,643**	**9,064,090**	**47 C-46, 37 DC-4, 33 C-47—DC-3, 1 Boeing**

*** Some carriers operate additional planes under long-term leases from the government and other carriers. Operating statistics in first five columns cover all planes operated, not just planes owned.**
Source: Quarterly filing reports to accounting and rates div., bureau of economic regulation, CAB.

Nonscheduled (Irregular) Air Carrier Aircraft

(Transport-Type Planes Only as of Jan. 1, 1951)

CAA REGIONS	ACTIVE OPERATORS		DOUGLAS		CURTISS	MISCELLANEOUS			TOTAL
	1/1/51	1/1/50	DC-4	DC-3	C-46	B-247	PBY	B-307	
1	10	14	2	5	9			1	17
2	23	19		12	40				53
3	1	3		4	1				5
4	1	4		4					4
5	1	0		1					1
6	20	19	13	18	7	1			39
7	6	8		5	12				17
8	0	9			4		1		5
9	1	1			1				1
Int.	5	3	25	3	18				46
TOTALS	**68**	**80**	**40**	**52**	**92**	**1**	**1**	**2**	**188**

Source: CAA Air Carrier Maintenance Branch.

of electronic navigation, landing and traffic control equipment capable of bringing planes in under a 100-ft. ceiling through ¼ mile visibility.

Any radical drop in ton-mile costs due to advanced-type engines and airframes for civil transports will follow their development first for the Air Force. That means about five years.

And the first application of turboprops will be to replace piston engines on existing Convair-Liners, Martin 4-0-4s, Super-Constellations and DC-6Bs. So a five-year depreciation rate on new civil transports appears conservative—airline accounting. As to pure-jet transports, their cost per ton mile is still considerably higher.

Gateway of the winds

This is the "throat" of the great wind tunnel in Boeing's aerodynamic laboratories. Through it, forced by giant fans, blow winds of ten times gale force—winds moving at the speed of sound!

The Boeing wind tunnel is already the only one of its size, speed and capacity owned by a single aircraft manufacturer. Now being substantially expanded, its improved aerodynamic research facilities will open a new field of precision testing on advanced-type aircraft at trans-sonic and super-sonic speeds.

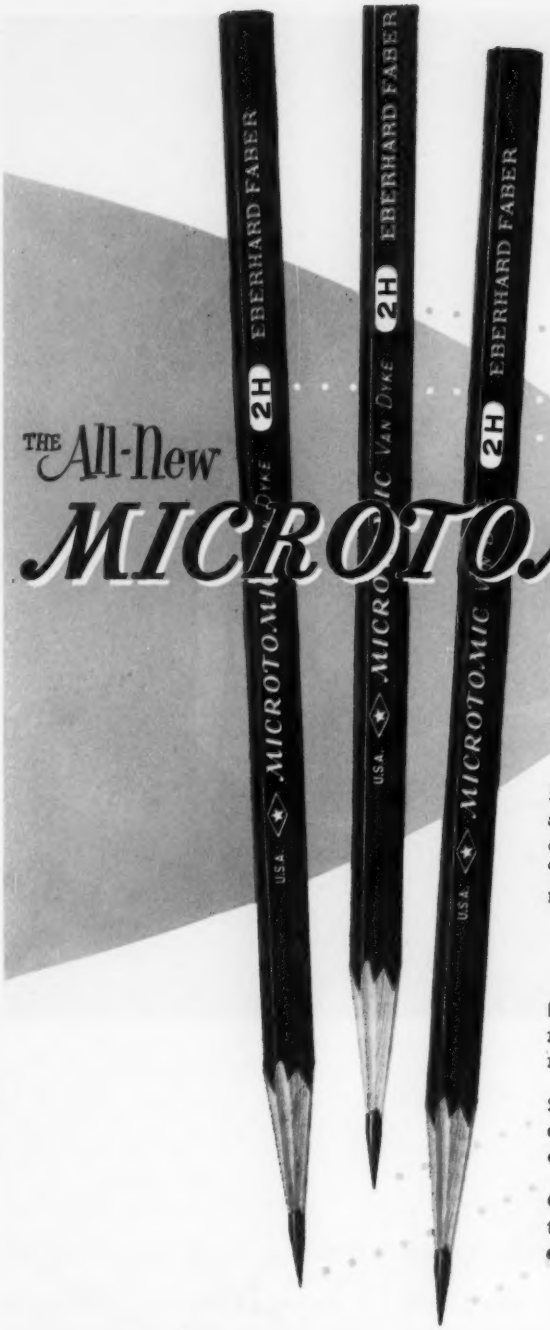
Delicate instruments record every detail as scale models react to varying air velocities in the tunnel throat. Structural strains are accurately calculated. Yaw and flutter are translated into lines on a moving graph. If there is a question about any part of the plane's design, the answer shows up here.

The wind tunnel is but one example of the unique research facilities available to Boeing's more than 3000 engineers.

Technical genius at the great Seattle plant has the finest of equipment at its finger tips. And neither equipment nor engineering know-how are limited to the field of aeronautics. The company's achievements in experimental research cover the whole broad range of technological development. When an engineering problem is put up to Boeing, you can count on results.

BOEING

Among Boeing's facilities for research and development are Acoustical, Aerodynamic, Armament, Electrical, Electronic, Flight Test, Hydraulic, Mechanical Equipment, Metallurgical, Physical Research, Propulsion, and Structural Test Laboratories, as well as the Boeing Wind Tunnel.



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Officially, the Air Force has scrapped plans for developing a super-modern efficient airlift transport. The conventional fleets existing and on order now will set the military transport type pattern for some years, according to present official plans.

MATS is satisfied with the DC-4 as a temporary airfreight and personnel backbone, and with the planes on order for higher performance: C-97 Stratofreighter for highspeed, high-altitude, long-range air freight; the C-124 Globemaster for extra-large or extra-bulky loads; the Constellations, Super-Constellations and DC-6As for high-speed, long-range personnel and cargo carriage. All of these but the tank-carrying C-124 are military counterparts of their conventional civilian models ordered by United, Eastern, and other airlines.

▶**Mobilization Day**—What happens to the airlines on M-Day? There are two schools of thought on this now: 1. The World War II scheme, where the military took over and operated the planes it needed; and 2. Charter airline services as needed.

The present plan, now in preparation by the National Resources Board Air Transport Task Group, is to charter airline services as needed. The Air Force, represented by Undersecretary John A. McCone, gives this scheme tentative approval. It is cheaper and more flexible for today's half-hot, half-cold war. But nobody knows what transport requirements will face the Defense Department in a sudden all-out war.

What would happen if war broke out on many fronts at once—all over the Asian periphery? The Air Force might grab the entire U.S. four-engine civil transport fleet of over 500 planes. The Air Force might do this despite earlier acceptance of the NSRB charter plan. Generals and their colonels are prone to "take over" the equipment they need when the real pinch comes. They may feel that outright command gives them better "control" of all equipment available, when the situation is desperate.

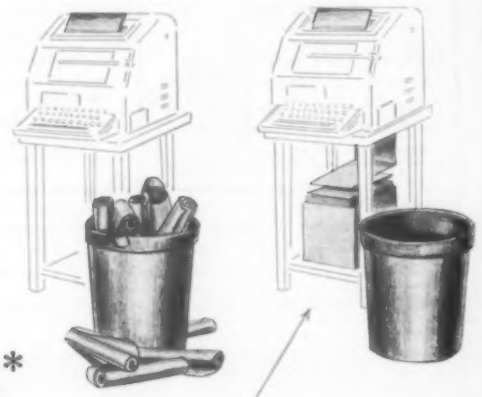
That is why there are two air transport mobilization plans—one official, the other stand-by, in case the Air Force decides on outright command and operation of civil transport outside the U.S. or even inside it.

▶**Charter Contracts**—The present Pacific Airlift is going on charters negotiated last summer. But AMC at Wright Field is working out a new formula for stand-by charter contracts in case of an all-out air transport mobilization.

This formula will take into consideration: 1. Cost-plus-charter of the airliner, providing a fair return on investment; 2. Allowance for added weight and loss of payload for modifications incorporated on airlift planes; 3. Indefinable factors subject to negotiation, the aim being to give the airlines a "normal" profit. This last factor involves the question of whether CAB or ATA should see to the airlines' getting fair profits from a national policy standpoint.

▶**World War II**—On Pearl Harbor Day, 1941, the domestic airlines had 378 planes. The military then took half. But increased load factor and daily utilization of equipment enabled the airlines, with only half their planes, to fly almost 75 percent as much traffic as before.

Similar conditions will probably prevail shortly after M-day of any World War III. Assuming a war, a rule of thumb prediction is for one-half the airlines' ton or seat mile capacity to go into military service. But the airlines, by increasing the payload capacity, the load factor, and the daily utilization, would do better than 75 percent of their former domestic business. By dropping promotional fares and many sales activities, the airlines should keep scheduled operations revenues close to former levels. Add to these its revenue from Air Force utilization of the other half of the airline fleet, and revenues might be considerably higher than present semi-mobilization receipts. But then, renegotiation and higher taxes would have to be considered.



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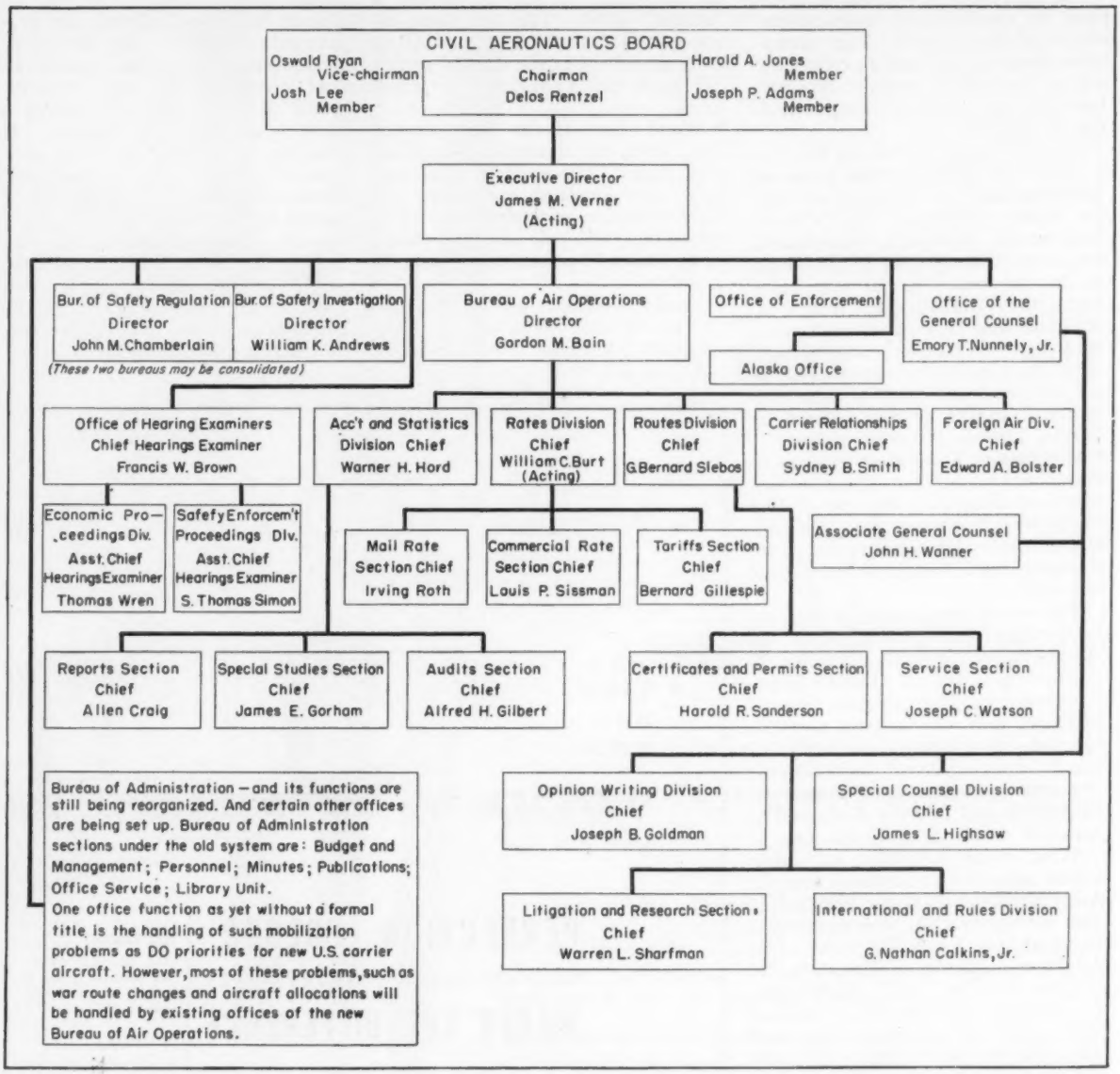

▶**How Many Planes?**—Civil Aeronautics Board Chairman Delos Rentzel, director of NSRB air transport mobilization planning, says U.S. mobilization and war increase the need for civil air transport. This at first appears to contradict firm plans to charter as many four-engine transports for military airlift as are needed. But actually, this means both the national production effort and the military will need all the planes they can get.

So the answer as to how the nation's civil transport fleet is divided in war depends on the war conditions. Looking at the NSRB plan, statistics, and arguments, Mobilization Director C. E. Wilson on the one hand and the Defense Department on the other will compare relative needs for air transport. Result will be something like this: in desperate circumstances, all but a bare minimum of the 500-odd four-engine U.S. transports will go to military lift. Some twin-engined planes may go too, but not many from the certificated airlines. The remainder of the civil air transport fleet—some 800 twin-engine planes and perhaps 100 four-engine planes will stay in commercial service to keep the mobilization economy efficient.

But this taking away of half or more of the civil airlift seems a crippling blow to production efficiency. War mobilization of the civil economy demands far more air transport of executives, technicians and freight than peacetime. The answer to this dilemma—more civil demand just when the military takes half or more of the civil air transport capacity—lies in travel priorities and increased load factors.

Assume a 60 percent normal peacetime load factor. In war, cut the plane supply in half, increase daily utilization of each plane and raise the load factor to 90 percent; you then have almost the same civil lift potential—albeit with some inconveniences. Throw off vacationers, visitors, orchids and shrimp and you have about the same capacity for essential air transport as before.

But just how the defense mobilization chief and the Air Force will cut the air transport melon, plane for plane, will depend on how they see the particular situation when it happens.

▶**Feeder Airlines**—The NSRB mobilization plan will probably put feeders on altered and in some cases modified routes and schedules. But current thinking is that local service air transport is important to a mobilization economy. Only three months ago, feeder curtailment in time of war

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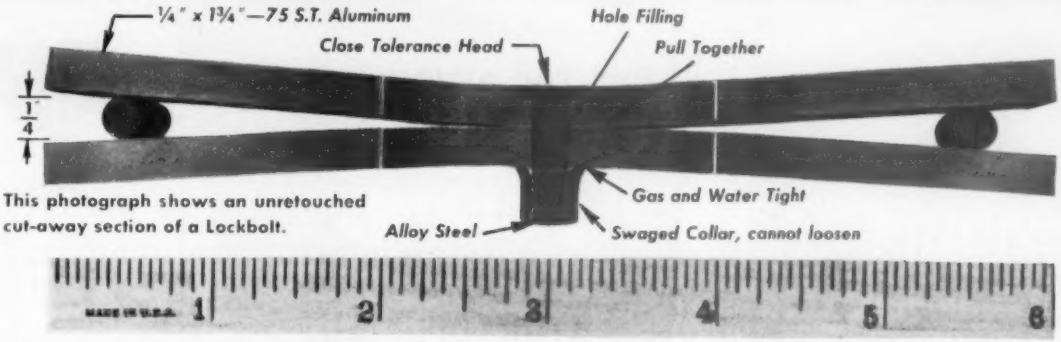

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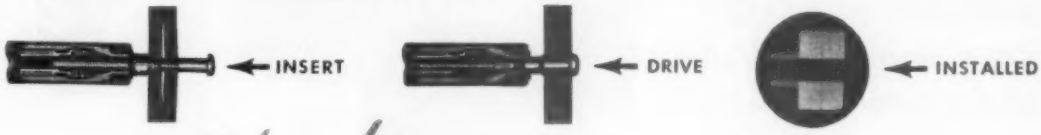

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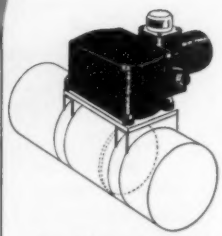
Geneva-loc Actuators position the valve by means of an accurate mechanical cam. Installation and service problems are virtually eliminated because there are no limit switches or clutch brakes that require critical adjustments.

Geneva-loc Actuators are time-tested equipment – more than 15,000 are in service. Solve your actuator problem by specifying the Geneva-loc Actuator which is currently in volume production by one of the oldest and largest aircraft component manufacturers and be assured of a reliable source of supply in the years ahead. Write for Bulletin BA 107.

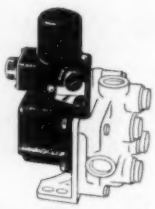
GENEVA-LOC ACTUATORS

Series	Positioning	Min. Actuation Time	Rated Load In. Lbs.	Max. Wt.
LM108	2- to 8- position 90°, 72°, 60°, 45°	1.25 sec.	30-70	2.0 lb.
LM118	2-position 90° only Currently available	.8 sec.	45	1.1 lb.

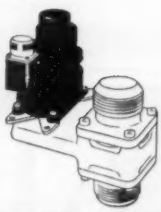
Filtered models (-4) are also available for installations requiring the maximum in radio noise elimination.



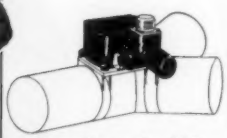
4 position series 108 as an air valve actuator



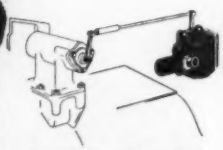
3 position series 108 as a hydraulic valve actuator



2 position series 118 as a gate valve actuator



8 position series 108 as a mixing valve actuator



2 position series 108 as an engine hi-low blower valve actuator

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Bendix Aviation Corporation
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U. S. Airline Operations

(Traffic)

Year	Total Passenger Miles	Air Mail Ton Miles	Express Ton Miles	Freight Ton Miles
INTERNATIONAL				
1943	254,374,000	1,990,715	(1)	(1)
1944	322,125,000	2,048,150	(1)	(1)
1945	462,180,000	3,399,339	(1)	(1)
1946	1,120,196,000	6,141,461	(1)	(1)
1947	1,863,268,000	12,755,998	30,786,465	2,109,948
1948	1,961,794,000	17,122,170	41,404,334	4,188,467
1949	2,033,054,000	24,401,628	49,443,023	6,714,414
1950*	2,222,108,000	26,271,480	42,586,551	10,034,982
TRUNKLINES				
1932	127,433,000	2,701,125	289,512	N.A.
1933	174,820,000	2,567,924	422,860	N.A.
1934	189,906,000	2,461,412	507,293	N.A.
1935	316,336,000	4,132,708	1,097,602	N.A.
1936	438,989,000	5,740,436	1,865,798	N.A.
1937	481,116,000	6,698,230	2,162,488	N.A.
1938	560,660,000	7,449,246	2,182,420	N.A.
1939	755,118,000	8,610,726	2,713,099	N.A.
1940	1,157,900,000	10,117,858	3,476,224	N.A.
1941	1,506,303,000	13,118,015	5,258,551	N.A.
1942	1,501,279,000	21,162,102	11,901,793	N.A.
1943	1,670,935,000	36,061,868	15,139,359	N.A.
1944	2,211,905,000	51,139,973	16,901,586	N.A.
1945	3,408,290,000	65,092,921	21,793,432	1,403,420
1946	6,088,315,000	32,953,307	23,788,392	14,822,325
1947	6,307,690,000	33,086,175	28,766,650	35,911,554
1948	6,227,932,000	37,925,396	30,092,833	71,283,727
1949	6,562,580,000	40,874,188	27,329,361	94,189,591
1950*	7,804,112,000	46,490,815	35,299,018	115,310,218
FEEDER				
1946	6,812,000	60,088	24,354	25
1947	53,452,000	176,700	131,925	83,772
1948	87,928,000	361,984	189,550	264,794
1949	133,821,300	427,621	320,143	435,606
1950*	184,940,622	548,210	620,437	743,579

(1) No segregation prior to Jan. 1, 1947.
N.A. Not available.
* Estimate.
Source: Air Transportation Assn.

Scheduled Airline Safety

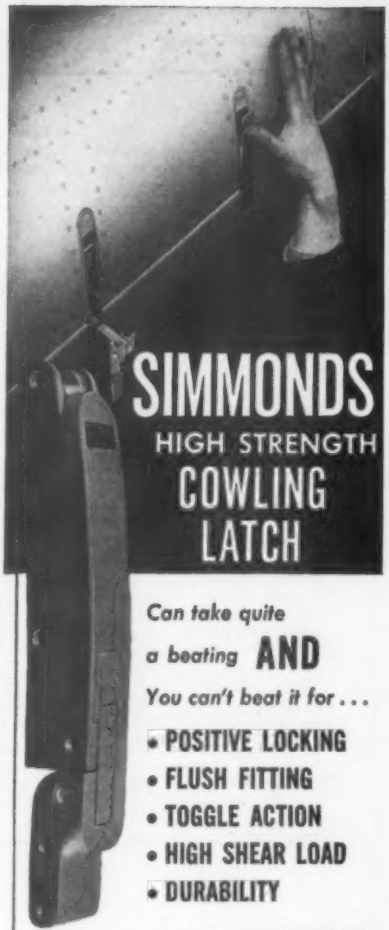
1938-1950

Year	Fatal Accidents	Passenger Fatalities	Crew Fatalities	Pass. Miles Flown Per. Pass. Fatality	Pass. Fatalities Per 100 Million Pass. Miles
DOMESTIC					
1938	5	25	10	22,400,205	4.5
1939	2	9	3	83,927,533	1.2
1940	3	35	10	33,114,118	3.0
1941	4	35	9	43,063,944	2.3
1942	5	55	16	27,286,599	3.7
1943	2	22	8	75,951,578	1.3
1944	3	48	8	47,907,077	2.1
1945	7	76	11	46,746,305	2.1
1946	9	75	22	80,894,782	1.2
1947	5	109	17	31,696,899	3.2
1948	5	83	15	75,035,336	1.3
1949	4	93	11	76,032,710	1.3
1950	4	96	13	85,000,000*	1.2
INTERNATIONAL					
1938	2	7	10	7,601,860	13.2
1939	1	10	4	7,826,592	12.8
1940	0	0	0	.....	0
1941	1	2	0	84,261,841	1.2
1942	0	0	0	.....	0
1943	1	10	4	25,437,434	3.9
1944	1	17	0	18,737,317	5.3
1945	2	17	10	19,584,343	5.1
1946	2	40	12	28,150,765	3.6
1947	3	20	13	93,163,400	1.1
1948	1	20	10	98,089,700	1.0
1949	0	0	0	.....	0
1950	2	48	7	48,200,000*	2.1

* Estimated.
Source: CAB.

mobilization was a foregone conclusion. Nobody bothered to look beyond the World War II experience, when feeders were virtually non-existent, and were therefore not missed.

Now the economy is dependent on scheduled air transport. If the U.S. industrial areas were blitzed by enemy A-bombs, local service scheduled air transport would be a vital link keeping war-industry assembly lines going despite spot parts shortages in factory towns all over the mid-west and other industrial regions.



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U. S. Scheduled Air Transport Industry

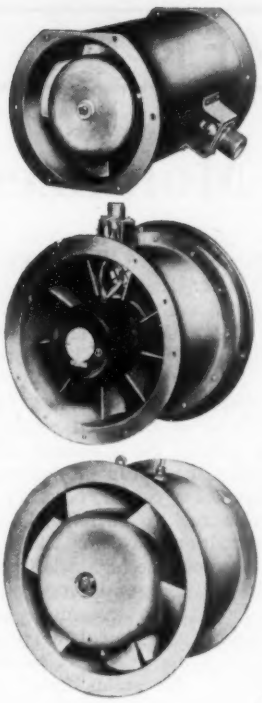
Carrier	Assets (Sept. 30, 1950)	Employes (Sept. 30, 1950)	Payroll Per Year	Unduplicated Route Miles Operated Dec., 1950[1]	Scheduled Rev. Pass. Miles, 1950	Number of Scheduled Passengers Flown, 1950	Planes in Scheduled Service Dec., 1950
DOMESTIC							
American	$134,335,557	10,999	$44,293,878	11,457	1,739,523,000	3,477,344	49 DC-6, 7 DC-4, 79 Convair
Foreign operations		356	420,815		68,361,000	89,869	
Braniff	14,400,345	2,180	7,881,540	10,672	250,406,000	683,934	6 DC-6, 9 DC-4, 13 DC-3
Foreign operations		302	825,924		43,335,000	20,849	
Capital	17,063,456	3,336	13,109,038	5,190	410,582,000	1,370,489	5 Connie, 25 DC-4, 3 Super DC-3, 25 DC-3
Chicago & Southern	7,924,388	1,163	4,669,600	5,749	117,600,000	361,497	3 Connie, 2 DC-4, 12 DC-3
Foreign operations		79	363,950		27,620,000	21,735	
Colonial	3,034,713	578	2,202,525	3,182	49,341,000	191,659	4 DC-4, 5 Convair, 8 DC-3
Foreign operations		38	199,416		18,731,269	23,130	
Continental	4,510,021	720	2,905,413	2,772	72,294,000	206,023	5 Convair, 10 DC-3
Delta	12,649,776	2,096	7,726,341	3,061	280,094,000	637,386	6 DC-6, 6 DC-4, 20 DC-3
Eastern	55,340,636	7,694	29,761,277	9,704	1,226,819,000	2,635,538	20 Connie, 25 DC-4, 49 DC-3
Foreign operations		19	53,580		22,927,000	19,320	
Inland	1,335,079	216	1,000,135	1,910	35,883,000	91,301	1 DC-4, 6 DC-3
Mid-Continent	4,679,114	1,048	3,993,061	3,462	102,516,000	346,435	4 Convair, 20 DC-3
National	11,201,599	1,732	6,524,369	3,185	242,775,000	369,163	8 DC-6, 7 DC-4, 11 Lodestar
Foreign operations		10	30,600		21,779,000	80,538	
Northeast	4,773,539	735	2,847,621	1,051	70,468,000	372,497	5 Convair, 8 DC-3
Northwest	47,620,560	4,681	19,654,056	20,454	511,104,000	799,222	10 Stratocruiser, 18 DC-4, 21 Martin 202, 2 DC-3
Foreign operations		579	2,313,587		102,243,000	55,238	
TWA	102,816,040	5,926	27,307,657	31,861	1,106,197,000	1,569,372	58 Connie, 14 DC-4, 51 DC-3, 12 Martin 202, 5 Boeing 307
Foreign operations		2,716	9,156,253		340,604,000	124,600	
United	105,135,571	9,666	40,519,696	13,250	1,424,847,000	2,495,000	44 DC-6, 23 DC-4, 58 DC-3
Foreign operations		289	1,851,336		70,029,321	28,974	
Western	10,345,326	1,089	4,555,906	2,817	173,580,000	459,065	5 DC-6, 10 Convair, 4 DC-3
TOTAL Domestic	**537,165,729**	**53,859**	**218,952,113**		**7,814,119,000**	**16,065,880**	
Foreign		**4,388**	**15,215,461**		**715,629,590**	**464,253**	
GRAND TOTAL	**537,165,729**	**58,247**	**234,167,574**	**129,777**	**8,529,748,590**	**16,530,133**	
INTERNATIONAL							
American Overseas					160,108,000	105,813	
Caribbean-Atlantic	N.A.	148	$374,506	388	N.A.	N.A.	3 DC-3
Hawaiian	2,691,158	439	1,803,281	402	42,178,000	326,135	13 DC-3
Pan American	209,727,394	11,549	43,337,096	60,014	1,257,200,000	1,016,407	28 Stratocruiser, 20 Connie, 60 DC-4, 16 Convair, 9 DC-3
Panagra	18,624,298	1,698	3,414,611	6,106	N.A.	N.A.	6 DC-6, 4 DC-4, 10 DC-3
Trans-Pacific	555,554	153	540,323	N.A.	9,711,000	77,945	5 DC-3
TOTAL	**231,598,404**	**13,987**	**$49,469,817**	**66,910**	**1,469,197,909**	**1,526,300**	
FEEDERS							
All American	2,396,338	410	1,538,119	1,741	21,214,000	150,195	11 DC-3
Bonanza	535,964	107	389,084	639	4,595,000	18,909	4 DC-3
Central	421,124	89	338,085	1,224	1,326,000	10,822	3 DC-3, 7 Bonanza
Empire	458,987	113	470,545	755	8,242,000	44,534	5 DC-3
Mid-West	184,805	61	235,579	1,215	1,002,000	6,940	3 Bonanza
Ozark	N.A.	N.A.	N.A.	2,223	N.A.	N.A.	5 DC-3
Frontier	1,515,046	568	1,983,293	3,146	17,479,000	65,626	12 DC-3
Lake Central	323,380	65	265,728	753	2,041,000	12,757	7 DC-3, 2 C-46, 8 Cessna 190
Non-scheduled operations				0	6,602,000	8,277	
Piedmont	1,505,104	369	1,218,863	1,884	26,089,000	123,762	8 DC-3
Pioneer	1,268,246	399	1,489,646	1,976	34,416,000	128,171	12 DC-3
Robinson	891,527	155	555,274	800	8,841,000	55,463	5 DC-3
Southern	1,091,273	217	724,022	1,918	6,568,000	38,053	7 DC-3
Southwest	1,450,716	260	1,035,530	1,136	22,236,000	118,860	11 DC-3
Trans-Texas	972,681	339	1,138,503	2,575	14,756,000	64,754	9 DC-3
West Coast	1,038,605	163	503,736	764	9,454,000	66,401	6 DC-3
Wiggins	213,645	23	86,824	610	288,000	3,186	6 Cessna T50
Wisconsin Central	839,138	218	845,278	1,642	7,764,000	48,797	6 Electra
TOTAL	**15,106,579**	**3,555**	**12,908,109**	**24,801**	**186,311,000**	**957,230**	

ALL-FREIGHT CARRIER PLANES IN SERVICE

Airnews, Inc. 2 DC-3
Flying Tiger Line 6 DC-4, 29 C-46, 1 DC-3
Riddle Aviation 3 C-46, 1 DC-3
Slick Airways 22 C-46
U. S. Airlines 6 C-46

[1] Includes foreign as well as domestic.

Source: CAB and carriers.



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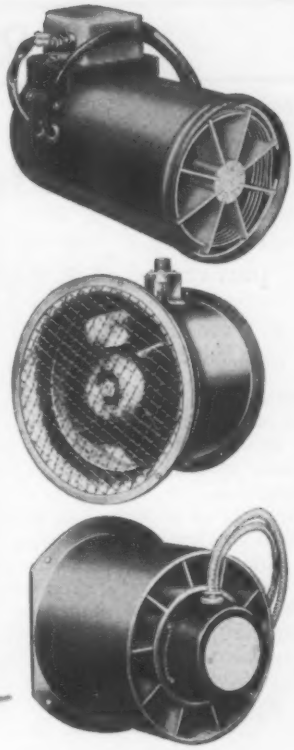

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Britain

Europe's Main Arsenal Slowly Mobilizes

Factories a year away from expanded production, but past record of high productivity is point in favor.

By Frederick R. Brewster
(*McGraw-Hill World News*)

London—After five uneasy years of peace—and lean times—Britain's military air strength is now slowly swinging back towards something like combat-readiness.

There's a lot of slack to be taken up. Both in equipment and in manpower, the Royal Air Force and naval aviation had been allowed to run down to a shocking state of unpreparedness. What resources were available had been concentrated on research and development.

It was a gamble that Britain had to take. Only events will determine whether she has come out safely.

The expanded program of rearmament which had just been announced as this was written will take effect only slowly. It will take at least a year for British factories to tool up for the expanded production of aircraft included in that program, and perhaps another twelve months before the additional aircraft are delivered to the RAF and Navy squadrons. Yet the second quarter of 1951 may be the critical time—the time when they would have been needed.

▶**Close Anglo-American Tie**—American global strategy from the end of the war in 1945 has counted heavily on Britain as an ally. George Orwell might have coined a more accurate description of Britain than "Airstrip One"—"European Arsenal Number One" would have put it more precisely.

For Britain's demonstrated ability to mobilize for quantity production of aircraft (among other key arms products) was—and still is—too valuable to lose. From a production of about 6000 aircraft in 1939, Britain's industry, by dint of widespread subcontracting, boosted this figure to 30,000 planes in 1944. At this peak level some 1.8 million workers were employed.

If war should demand it, a similar expansion might be possible again. At the moment, however, the aircraft industry is idling along at about one-tenth its wartime peak. And so far nothing like that ten-fold expansion is being called for.

But the organizing know-how—and most of the factory-space—is still extant, even though much of the workforce and the factory-space have been converted to other purposes in the past five years.

Britain's limited objectives, during these five years of comparative peace, have been to preserve an air-defense with some hope of warding off a frontal assault by enemy bombers; to strengthen its wide-flung Commonwealth defenses and lines of communication; and to pursue the technical program of research and development that had to be suspended during Britain's all-out war effort against Germany.

The British have not had the resources, they insist, to build a large air force in being. That's why, with some reluctance, they have accepted the American "gift" of 70 surplus B-29s, to give RAF Bomber Command a long-range-force superior to the Lincolns. That's why, with less reluctance, they have welcomed the implicit combat power of the 90 USAF bombers (at first B-29s, currently B-50s) which have been based in the British Isles, ostensibly for training. And the USAF F-84s which have more recently been added to the Third Air Division's strength, as fighter-protection, have had the same welcome.

But all along, Britain has looked forward hopefully to the day when she could again rely on her own strength.

▶**European Integration Under NATO**—Signing of the Atlantic Pact tossed another hopeful factor into the picture. The idea of mutual assistance fell on fertile ground in Britain (as it did elsewhere in Europe), for it meant that she could put off for a little longer the need to stand on her own feet alone. And Britain saw in the coordinated production for defense a further opportunity for her aircraft industry to remain a major supplier of aircraft to other European air forces besides her own.

The North Atlantic Treaty Organization (NATO) has been getting under way slowly. No grandiose pattern of integrated European production has yet been drawn. So far, NATO's Supply Committee has merely laid down recommendations as to where the manufacture of nine high priority items might be advantageously concentrated. These have been recommendations only; member governments alone could place the orders. And Continental members of the group have so far been reluctant to place those orders until they saw the color of the U. S. money that was promised under MDAP.

Establishment, soon, of the NATO Defense Production Board, under the direction of William Herod (formerly president of International General Electric Co.), may light a fire under those member-governments. But DPB isn't a going affair, yet.

But the expansion of British production, announced at the end of January by Prime Minister Attlee to a sober-faced House of Commons, is closely aligned with the recommendation of the NATO Supply Committee. And while the bulk of that expanded production is intended for use by Britain's own forces, some of the aircraft and tanks, it is understood, will be available for other NATO countries. And the greater productive capacity that will be set up, under the British program, will certainly be an asset for whatever integrated production scheme

(*Continued on page 116*)

British Aircraft Exports:

	1948	1949	1950
Complete aircraft:			
number	1123	1248	852
value	£14,313,165	£19,946,393	£14,078,913
Engines:			
number	1363	1674	1708
value	£ 3,237,943	£ 4,976,830	£ 5,244,774
Tires and other parts:			
value	£ 8,453,676	£ 9,293,521	£14,951,736
Total value	**£26,004,784**	**£34,216,744**	**£34,275,423**

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DH Heron

Bristol 175

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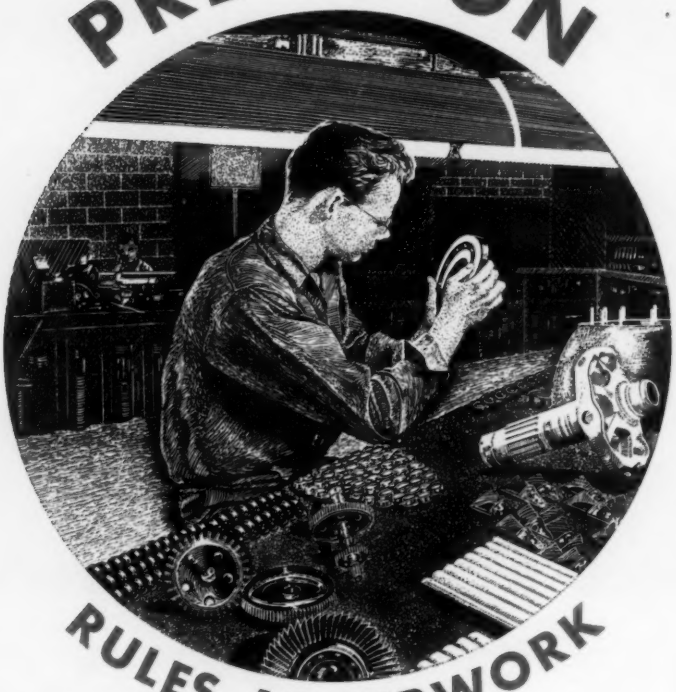
Boulton Paul Balliol 2

DH Venom 2

PRECISION



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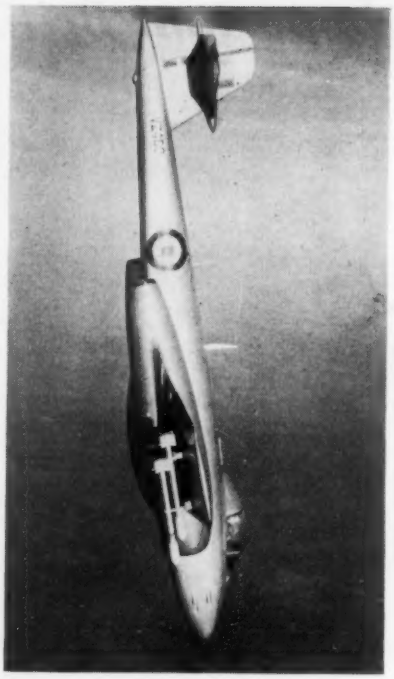


Meteor 8 in. near-vertical dive.

for Europe DPB eventually maps out.

►**Details of British Expansion**—Only the broad outline of what Britain plans to do was given by Mr. Attlee. But this is sufficient to draw some observations as to what it will mean to Britain's (and Europe's) potential air power.

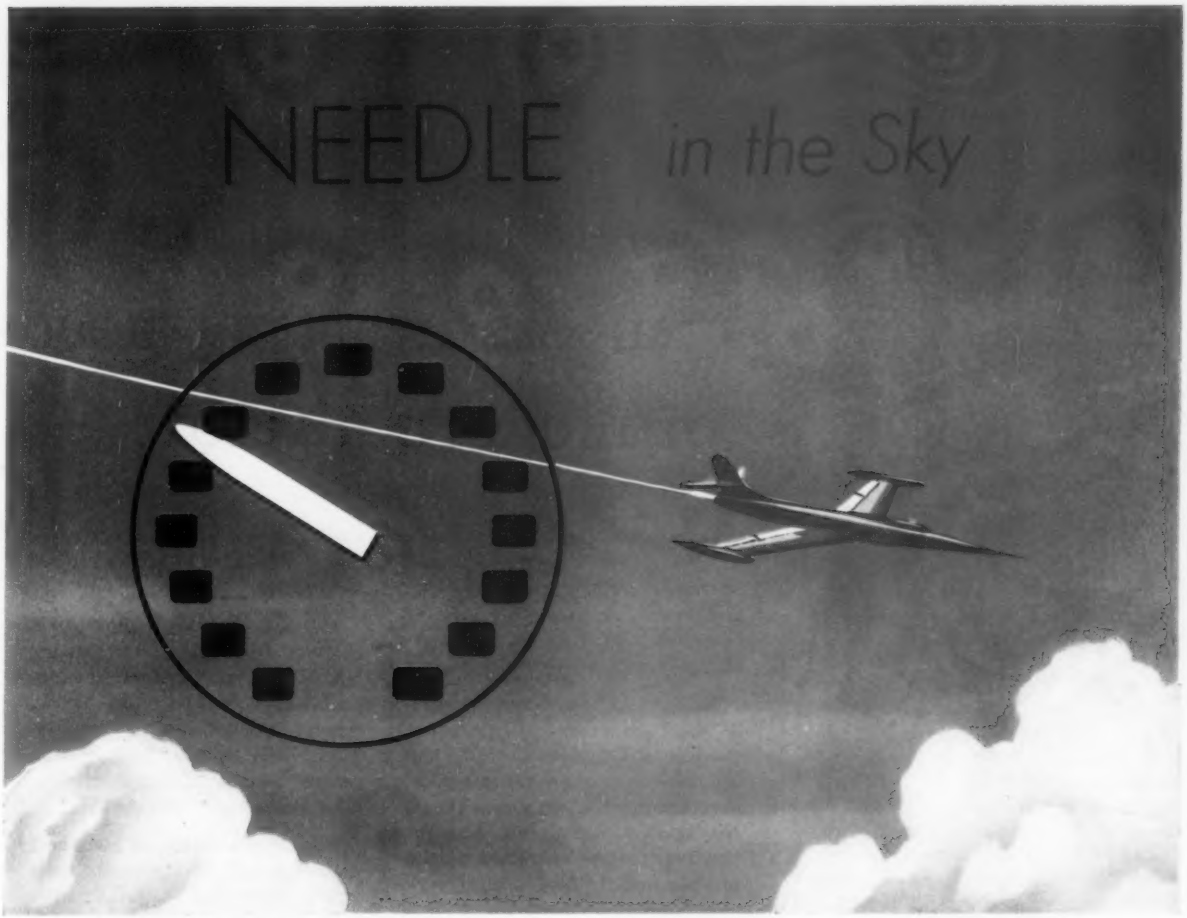
Production during the coming year for all forms of armament will rise from the past year's level of £250 million to double that figure; this will go up to perhaps £800 million in 1952; and is expected to reach £1000 million in 1953, or four times the present level. This means that roughly half of the three-year commitment of £4,700 million for defense will go for production —£2,300 million.

Expenditures on aircraft, originally budgeted for 1950 at £55 million, have been upped twice during the year so far, although the money probably will not be spent this financial year (ending Mar. 31) and so will not be reflected in the final total of the estimates.

A conservative estimate, however, is that nearly £200 million will be spent for military aircraft during 1951, and this amount will probably increase in the subsequent years at the same rate, at least, as the total expenditure on production. (That is, in 1953, expenditure might reach as much as £400 million.)

The pattern of this production was already clear before the recent announcement. While the designs to be ordered were concentrated on a relatively few types, the size of the orders

(*Continued on p. 121*)



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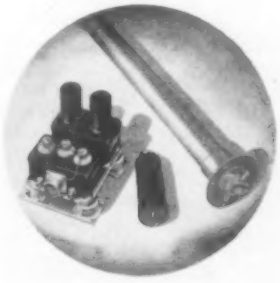

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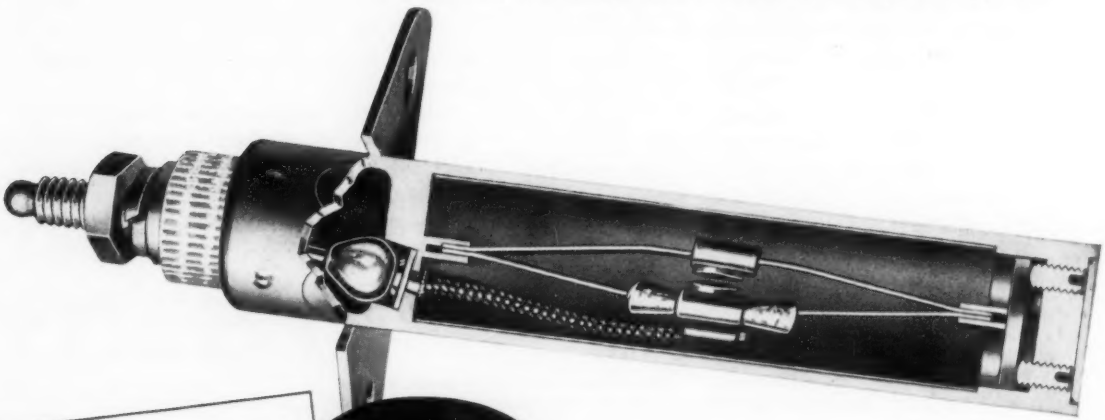

THROUGH PROPER SELECTION of alloy metals of shell and strut assembly Fenwal engineers design dynamic fire and over-heat detection for specific aircraft needs. The shell is the temperature-sensitive, activating element. Units comply well within CAA Technical Standard Order C-11 in accordance with the SAE, specifications AS-401.

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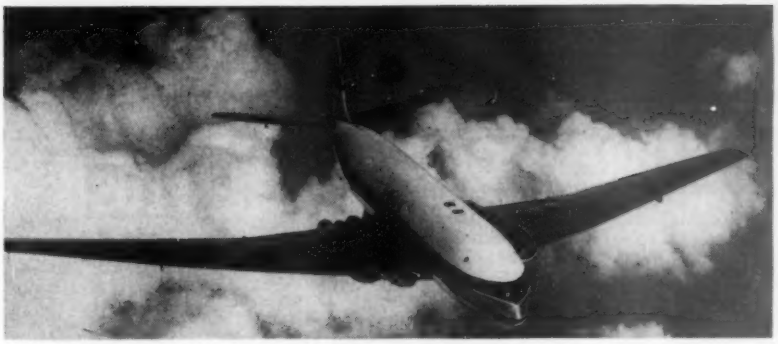
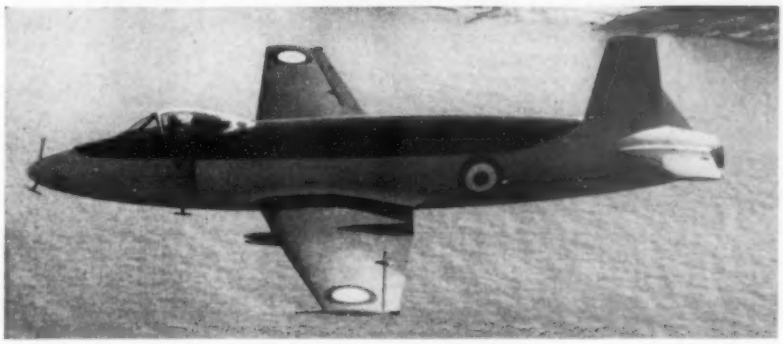
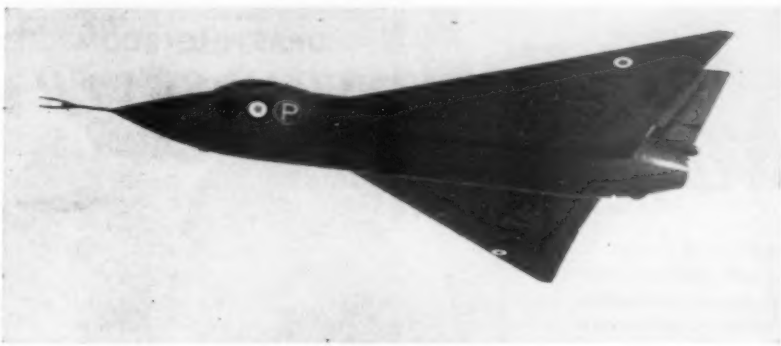


de Havilland Comet



Vickers-Armstrongs Attacker 1



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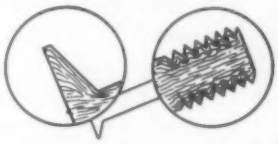

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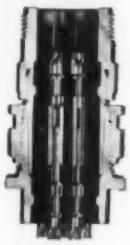

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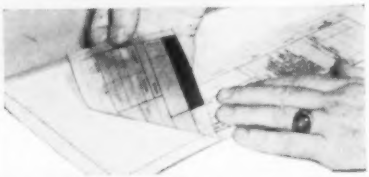

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was such as to call for teaming up the whole of the traditional aircraft building industry.

► **RAF Needs**—For the RAF, the demand is for more and more jet fighters, and for the Canberra twin-jet bomber. To these is now added the four-jet longer-range bomber which has been in the development stage for more than five years but has not yet flown. Both A. V. Roe and Handley Page have been working on such a project, and Mr. Attlee's announcement that the big bomber has been ordered "off the drawing board" suggests that both firms will be producing the single design selected.

Meanwhile, the Gloster Meteor 8 jet fighter is already coming off Gloster assembly lines from components built in a large number of Hawker Siddeley Group members' factories. And de Havilland's Venom jet fighter, which will be replacing the Vampires, has now been subcontracted to Bristol Aeroplane Co.'s works to speed its deliveries.

Production of the English Electric Canberra is already underway at that firm's plant at Preston, and has also been undertaken by three other firms: A. V. Roe, Handley Page, and Short Bros. & Harland.

To get sufficient Avon engines for the Canberra orders, Rolls-Royce will have to open a new factory at Hillingdon, Glasgow, and will also subcontract the engine manufacture to Bristol and D. Napier & Son.

The RAF's night fighter, the N.F. 11, is already being turned out by Armstrong Whitworth at Coventry.

► **Royal Navy Fleet**—The Navy has its own turbo-powered fleet coming along, too. Both the Vickers Supermarine Attacker (straight-wing original version, adapted with folding wingtips for carrier-based operations) and the Hawker Sea Hawk are in production. A Naval version of the de Havilland Venom, for both day and night fighter duties, has also been ordered. And two turboprop types have now been selected for carrier duties: the Fairey 17 anti-submarine reconnaissance plane, which will carry a crew of three for long-range patrols, and a load of "killer" weapons like sonobuoys and depth bombs; and the Westland Wyvern attack plane, to make strikes against both sea and land targets.

The Navy's air strength was given another potential boost when the new Ark Royal was launched in May, 1950, to join its sister-ship, the Eagle at the fitting-out docks. In October, the Admiralty disclosed that six new aircraft carriers will be joining the fleet between then and 1954—the Eagle being due for commissioning this year.

(*Continued on p. 125*)

Safe, dependable flight begins with good maintenance ... good maintenance begins with Greer Test Equipment!

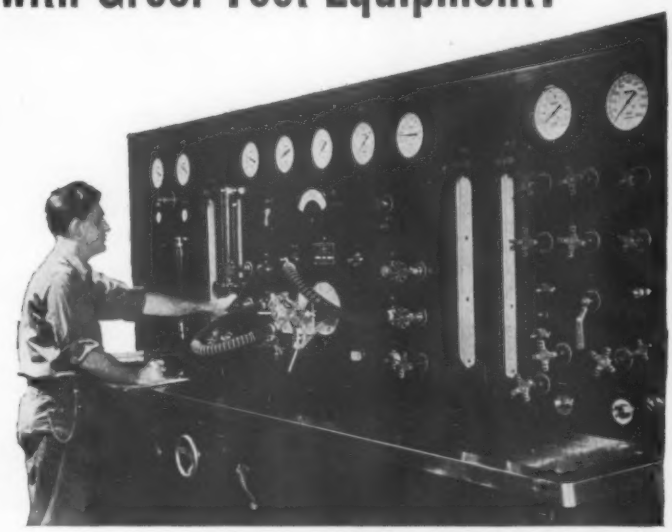

Photo courtesy Durham Aircraft Service, Woodside, New York

The Greer Combination Test Machine FVHPA20-1H (shown above) is truly the first master test bench especially engineered to meet the exacting requirements of practically all aircraft service and maintenance tests of airlines and aircraft manufacturers.

This versatile, easily-operated tester gives fast, accurate checks of fuel pumps rated up to 5400 pounds per hour, vacuum pumps to 80 cubic feet per minute, hydraulic pumps to 20 gpm, and hydraulic accessories operating at pressures up to 3400 psi. For static and leakage tests a 10,000 psi foot-pump is also provided. Write Greer today for complete, detailed specifications.

Aircraft dependability, passenger safety and comfort depend upon continuous, efficient operation of all accessories. So why gamble with questionable components. Test, be sure with Greer equipment, the world's finest.

Greer Engineers are always ready to help you with your test and maintenance problems. Tell us about yours today. Company letterhead please. There's no obligation of course. Write or phone for complete information on the new Greer Combination Test Machine. Ask for specification sheet 20-B.

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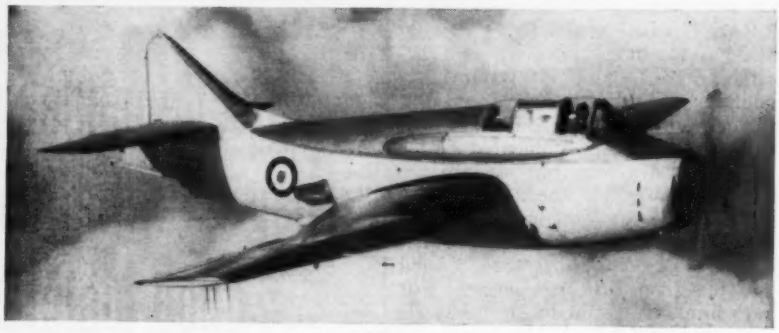
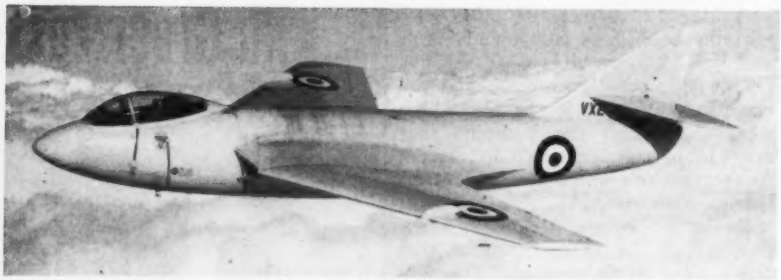
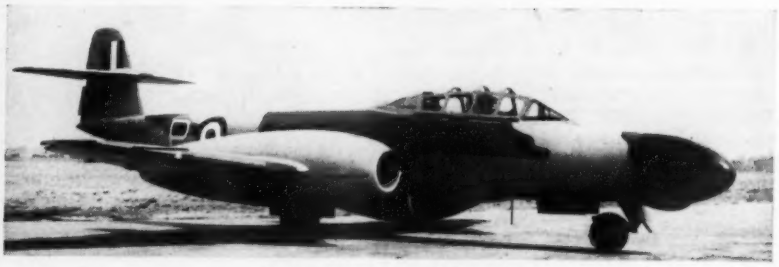
Among British Planes . . .



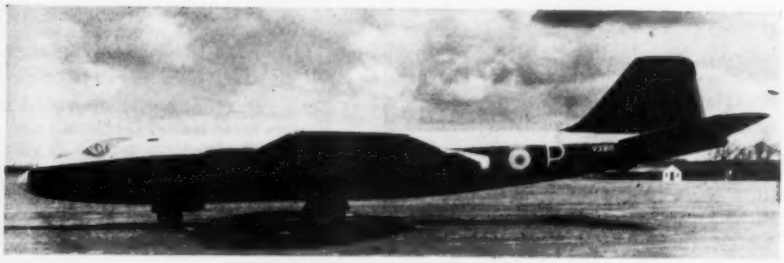
Fairey 17



Hawker P.1081



Armstrong-Whitworth N.F.11

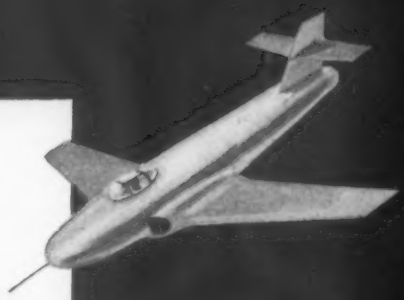


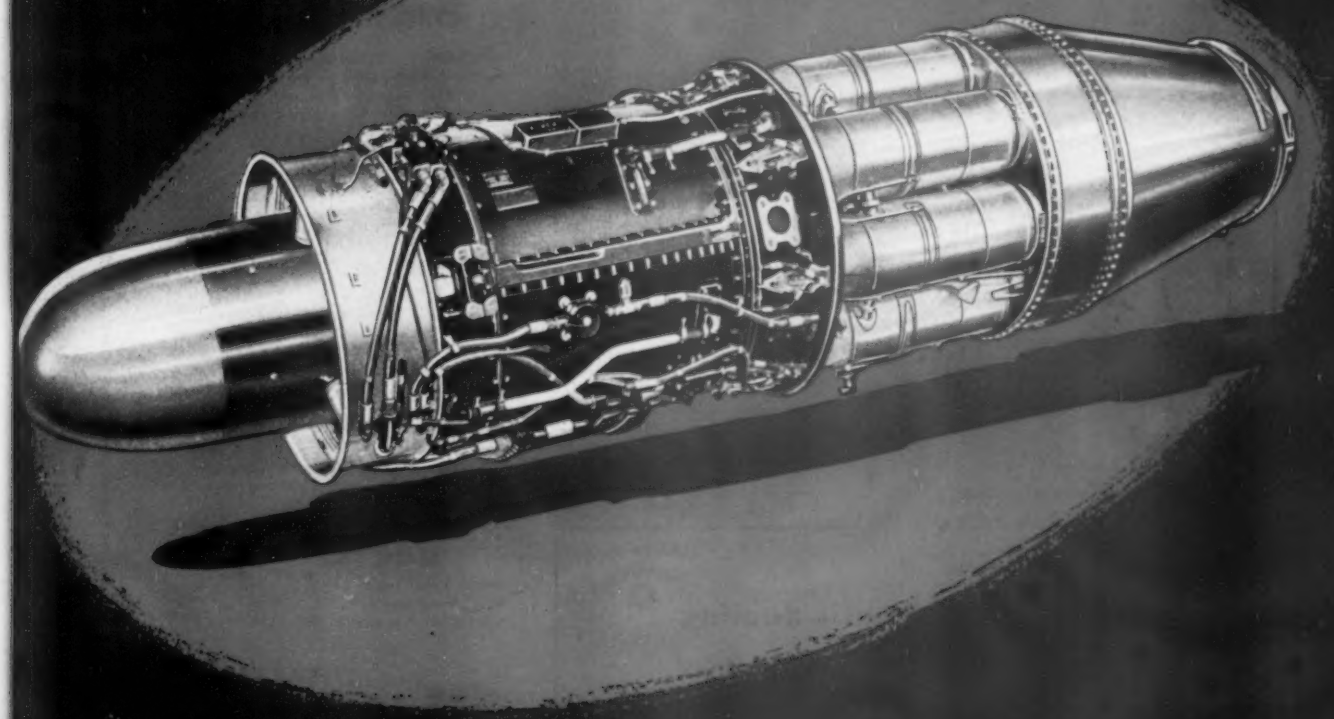
English Electric Canberra B Mk.2

Vickers-Armstrongs Viscount

SHARON STAINLESS

HAS WHAT IT TAKES FOR MODERN AIRCRAFT PRODUCTION





Where parts must be light in weight, yet absorb the heavy punishment of high speeds, high temperatures, and corrosive elements, they can be better made of Sharon Stainless Steels.

Aircraft manufacturers have fashioned hose clamps, shrouding bands, thermostats, baffles and many other parts from this versatile alloy, because Sharon Stainless has an extremely high strength-to-weight ratio, high heat resistance, low coefficient of expansion, high rust and corrosion resistance, and a constant uniformity unsurpassed in the industry.

For complete data on Sharon Stainless check with the Sharon office in your area. They're listed below and in the yellow pages of your phone directory.

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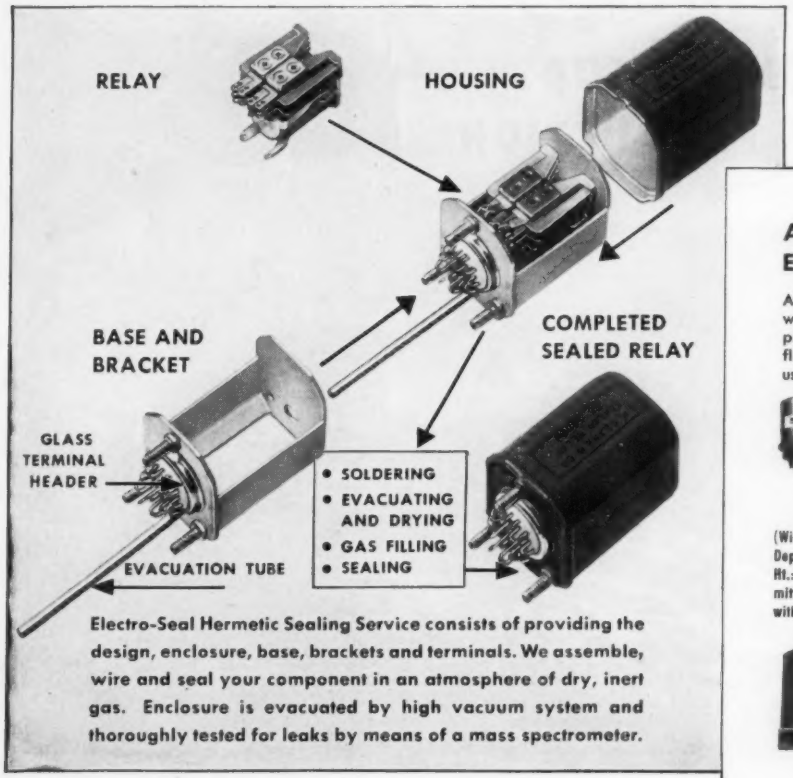
DISTRICT SALES OFFICES: Chicago, Ill., Cincinnati, O., Cleveland, O., Dayton, O., Detroit, Mich., Indianapolis, Ind., Milwaukee, Wis., New York, N. Y., Philadelphia, Penna., Rochester, N. Y., Los Angeles, Calif.,

Make atmosphere a part of your product



Electro-Seal Hermetic Sealing Service consists of providing the design, enclosure, base, brackets and terminals. We assemble, wire and seal your component in an atmosphere of dry, inert gas. Enclosure is evacuated by high vacuum system and thoroughly tested for leaks by means of a mass spectrometer.

A FEW STANDARD TYPES OF ELECTRO-SEAL ENCLOSURES

All Electro-Seal Enclosures can be equipped with individual terminals, multiple headers or plug-in arrangements as well as mounting flanges or studs. Dimensions given are inside usable dimensions.

SERIES 5-E

(Dia: 1 ½", Depth: 1 ⅞", Overall Outside Ht.: 2 5/16"). Normally equipped with octal plug.

SERIES 6-E

(Width: 1 ⅞", Length: 4 ⅜", Depth: 2 15/16", Overall Outside Ht.: 3 1/16"). Size frequently permits sealing several components within the enclosure.

SERIES 8-E

(Dia: 2 1/64", Depth: 2 ⅞", Overall Outside Ht.: 3 ½"). Normally equipped with octal plug. Maximum base area required: 2 ½" x 2 ½".

SERIES 13-E

(Width: 1 9/64", Length: 1 33/64", Depth: 2 3/16", Overall Outside Ht.: 2 ⅜"). Base provided with three mounting studs.

SERIES 14-E

(Width: 1 9/16", Length: 2 ⅜", Depth: 2 11/32", Overall Outside Ht.: 2 ½") Size frequently permits sealing of several items within the enclosure.

Electro-Seal Hermetic Sealing Increases Usefulness, Life and Freedom from Maintenance of Many Types of Electrical Products

No matter how efficient and dependable your product . . . relay, transformer, flasher, timer, amplifier, vibrator or other electrical device . . . it will only operate most reliably in "ideal" atmosphere.

Electro-Seal Hermetic Sealing Service permanently surrounds your product with atmosphere free of moisture, dust, fungi or pressure changes . . . makes it tamper-proof.

For aircraft use, hermetic sealing guards against failure caused by varying air pressure and condensation. In industry, it provides a safe enclosure in hazardous locations and complete protection from dirt and dust.

Let us show you how Electro-Seal Hermetic Sealing Service can add to the life and reliability of your product by making atmosphere a "built-in" part of the product.

Enclosures can be made up by temporary tools to provide small quantities for engineering samples or limited production schedules. We invite you to send complete engineering information and samples of parts to be hermetically sealed.

ELECTRO-SEAL CORPORATION

946 LEE STREET • DES PLAINES, ILLINOIS

Meanwhile, all of the Navy's carriers are having their decks strengthened to take the heavier new aircraft, and experiments are continuing with flexible flight-decks, which might be employed in the landing of a flying-boat type of aircraft which would also be suitable for water landings. This should be interpreted without difficulty as meaning that there is still a future for the Saunders-Roe jet flying boat fighter, the SR.A/1, which has been undergoing steady development since it was shelved by the RAF some years back. Moreover, the Navy was instrumental in encouraging Westland Aircraft to obtain a license to manufacture the larger Sikorsky S.55 helicopter, which, it is understood, will be given extensive anti-submarine and air-sea-rescue duties.

▶**Civil Airliners' Parade**—The concentration on research and development during these past five postwar years has borne its ripest fruit in the civil aircraft field, where the de Havilland Comet four-jet airliner, and the Vickers Viscount four-turboprop transport shine as brightly in the firmament as any American type. Both are in production for British operators, and may possibly break into the American scene at an early date, as well as hold for British aircraft its traditional export markets in South Africa, Australia, and Canada.

Britain's two nationalized airline corporations made steady progress toward black-ink operations, which can be explained partly by their acquisition of more modern and more economical postwar aircraft (in the case of BOAC, especially), and partly by the ruthless application of good-management to an over-staffed organization.

The Sun Never Sets On British Jets

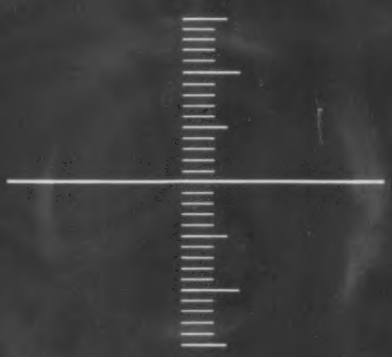
Two-thirds of the world's major air forces are now said to be equipped with British jet aircraft. This is one result of England's intensive export drive.

The attack of the British aircraft industry on export markets has shown increasing results since the end of World War II. In 1950 they totaled $98 million; in 1946 they had been only about $40.5 million. Total exports since the war come to $364 million.

Military aircraft have accounted for a great part of Great Britain's exports in this period. These have gone to British Commonwealth of Nations customers, Western Union nations and other allies throughout the world.

Additional export revenue is derived from licensing agreements. Eleven different foreign nations now hold a total of 24 British licenses to manufacture British planes and engines.

KOLLSMAN



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For over twenty years, meticulous craftsmanship and unsurpassed engineering skill have made the name of Kollsman synonymous with precision. Specialists in the fields of instrumentation and remote control—particularly where a pressure-sensitive element is the basic motivator—Kollsman laboratories include among their precision products:

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France

Industry Reorganization Pays

Five military airplanes in production, with several hundred on order and output climbing rapidly.

By Boyd France
(McGraw-Hill World News)

Paris—France has begun to rebuild a fighting air force after ten years of aeronautical stagnation.

The hard-headed French Five-Year Plan for the total reorganization of the aviation industry and the air force (AVIATION WEEK, Feb. 27, 1950) was approved integrally by the French National Assembly in August, 1950 and has made a good takeoff.

▶**The Production**—Five military aircraft already are in production. They are: the MD 450 Ouragan, powered by a French-built Nene; the Vampire 5 built under license at the Marignane plant of the Sud Est company, and powered with a Goblin turbojet; the MD 315 light cargo plane; the SIPA 111 and 112 trainers; and the Morane Saulnier MS 732 trainer.

Twelve MD 450s are slated to be in active service by the end of this year. One hundred and fifty more have been ordered and will begin coming off the assembly lines at the rate of 40 per month early next year. An order for another 150 Ouragans probably will be placed soon.

A batch of 224 Vampires powered with Goblins imported from Britain will begin coming off the assembly lines this year. Another 210 Vampires powered by French Nenes have been ordered.

MD 315s now are being built at the rate of six per month; 295 have been ordered. A total of 100 SIPAs has been ordered. Finally, 15 MS 732s are under construction.

The above figures may not sound very impressive alongside U. S. production statistics. But they are infinitely better than figures a year ago when French military airframe production totaled exactly zero aside from prototypes. And it takes time to set up mass production assembly lines starting from scratch.

But the explosion of the Far Eastern crisis has posed in a more brutal form the old question—will France be able to produce enough air protection in time?

▶**Time Running Out**—Because the Five-Year Plan was designed to build an air force capable of carrying out the military mission confided to France before Korea by the Brussels and Atlantic Pact strategists, it assumed a minimum of two years of peace in which to lay the groundwork of the new air force.

It called for only 25 Continental French fighter groups by 1953; only 41 by 1955. That equals 10,100 metric tons worth of aircraft for the air force and 4300 metric tons for the Naval Air Force by the latter date. (France now could put into the air only 15 motley combat groups of which only 20 squadrons are equipped with Vampires—two of them with Vampires made in France.)

Korea and the undeclared China war obviously have thrown this timetable off. It will be up to General Eisenhower and his staff to spell out what the necessary speed-up will mean in terms of French air power.

French airmen think the problem is largely a quantitative one. They believe that the types of airplanes scheduled to be delivered under the Five-Year Plan are those needed to do the

(*Continued on page* 132)

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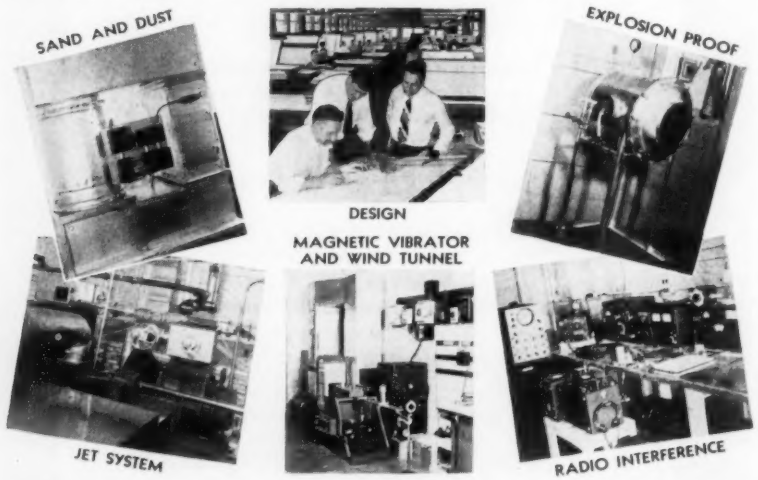
DESIGNS *and* TESTS
To All Applicable Government Specifications

TYPICAL FACILITIES FOR TESTING BARBER-COLMAN PRODUCTS



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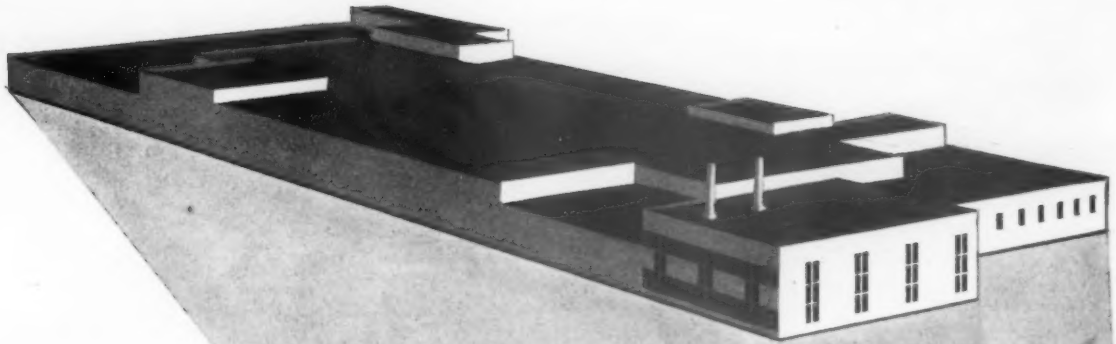
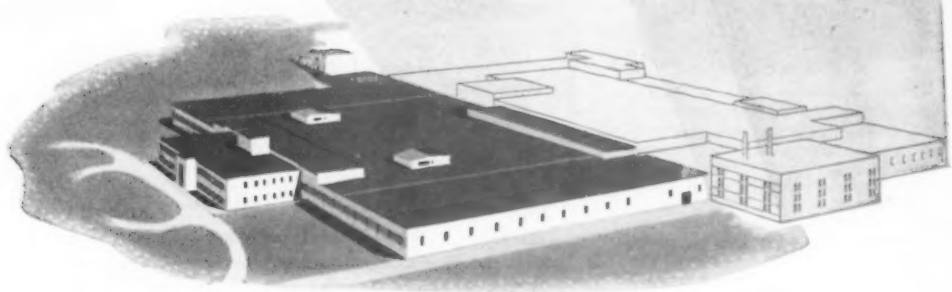


MORE PRODUCTION!

new Aeroproducts plant will double capacity!



Aeroproducts' huge expansion program is on its way. Ground has been broken for the new plant and *by the end of this year, present production capacity will be more than doubled!*

This rapid expansion of facilities will *more* than enable Aeroproducts to meet Air Force demands for Aeroprops on the giant Fairchild C-119 . . . *more* than meet the Navy's needs for turbine propellers on the Douglas A2D, the Consolidated Vultee R3Y and others. For Aeroproducts is planning for tomorrow . . . looking forward to a constantly increasing demand for its products. And whatever the future may hold, Aeroproducts will be ready—fully prepared to build propellers for giant new airliners . . . or for the swift-moving bombers, fighters and transports of our armed forces.

Yes, Aeroproducts, backed by the full facilities of General Motors, is ready to meet the demands of today... and is well on the way to meeting the accelerated demands tomorrow may bring.

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DAYTON, OHIO

Building for today
Designing for tomorrow

AEROPRODUCTS GM

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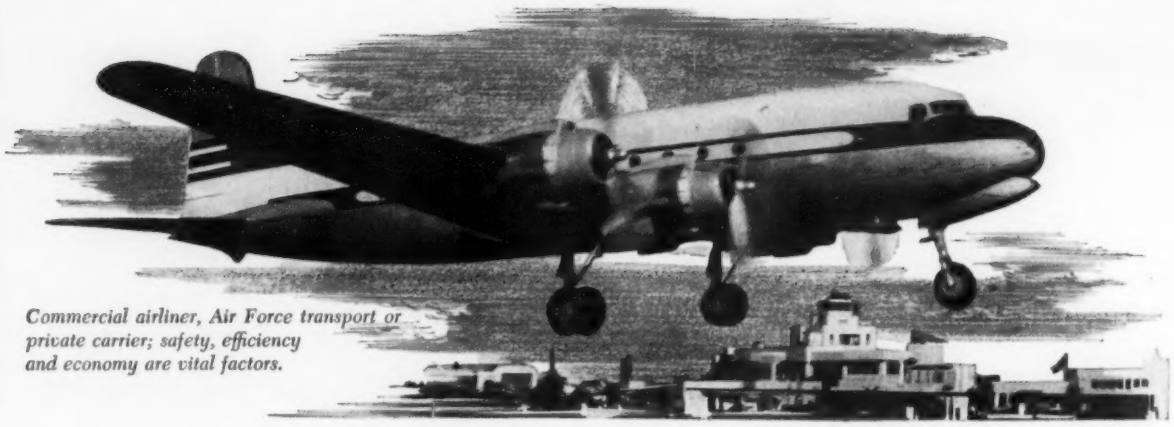
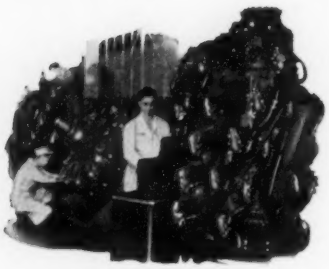
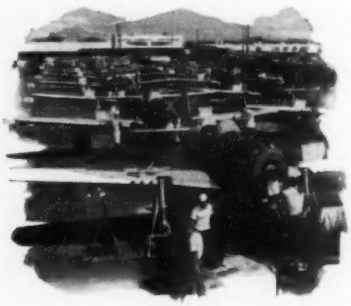


Commercial airliner, Air Force transport or private carrier; safety, efficiency and economy are vital factors.

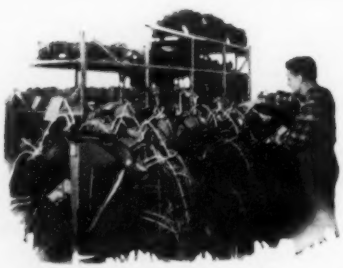


ENGINE OVERHAUL *is one of PAC's major operations. We pull 'em down and put 'em back quickly and efficiently.*

AIRFRAME OVERHAUL *is another important PAC function. For example, a large number of F-51's and C-54's are in process at two of our six branch locations.*



MANUFACTURING *accounts for an ever increasing portion of total effort. PAC's pressurization systems for high altitude aircraft are standard equipment on many fighter and transport craft.*



PARTS DISTRIBUTION *for major parts manufacturers is handled by PAC throughout the world. Pratt & Whitney, for example, appointed PAC as their first parts distributor.*

THE STRUCTURE of Pacific Airmotive activity is composed of four basic divisions, Engine Overhaul, Airframe Overhaul, Manufacturing and Parts Distribution. Each division is under the supervision of, and operated by, the most highly skilled and experienced men. Twenty-year service is not unusual among PAC craftsmen. The rapid growth the entire PAC organization has shown during the past years proves that its services and facilities are highly regarded by the entire aircraft industry. Quality of PAC engine overhaul has repeatedly extended the time between overhauls... increasing efficiency and profits for many Pacific Airmotive clients.

And, of course, PAC is the first and largest distributor of Pratt & Whitney Engine parts in the world! Also, scores of other leading parts manufacturers are represented by Pacific Airmotive. PAC activity in the airframe overhaul field over a period of many years has resulted in facilities to handle aircraft from the smallest private ship to the large troop carriers. An example is the vast reconversion and modification program on F-51 fighters and C-54 military cargo carriers undertaken for the Air Force. PAC manufactured pressurization equipment is found as an integral part in 90% of all modern fighters and pressurized commercial transport craft.

★

It's great to work and live in sunny California. Engineers, and many categories of skilled aircraft workers are needed by PAC... drop us a line.

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Rubber Parts...

NEW CATALOG CONTAINS DATA ON COMPOUNDS, APPLICATIONS AND FABRICATION METHODS

This 16-page, illustrated, multi-colored catalog now is available to design, production, purchasing and management personnel. This publication has been compiled to familiarize readers with Stalwart-developed rubber compounds which feature resistance to (1) abrasion, (2) chemicals, (3) high and low temperatures, (4) petroleum products and derivatives, and (5) weathering. Sections of the catalog are devoted to the new and outstanding Silicone Rubber compounds, the major methods of fabrication, and Stalwart production facilities.

More than 60 Stalwart-developed compounds are listed by code number. Charted individually in conjunction with these compounds are their physical properties and general characteristics, as well as suggested applications.

Catalog 51SR-1 will be sent upon receipt of coupon or on letterhead request.

STALWART RUBBER COMPANY

THE STALWART RUBBER COMPANY

Please send (without obligation) your new 16-page, illustrated, multi-colored Catalog 51SR-1.

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10 years of intensive, specialized development in aviation temperature control. 50 years' engineering research and manufacture of controls for the transportation industry.

Your assurance of advanced engineering and more positive, accurate, durable temperature control for aircraft.

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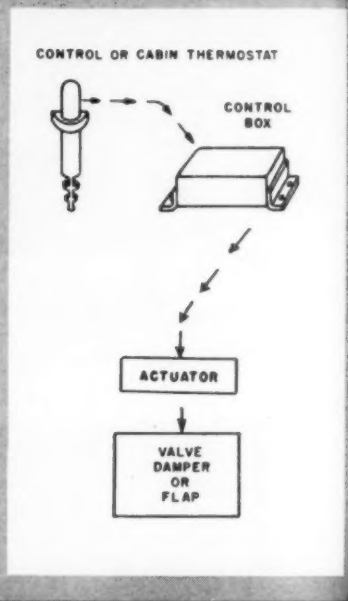
Smooth Pulse Modulation

Temperature control has kept pace with development of higher aircraft speeds—split second timing, plus Vapor's *Smooth Pulse Modulation* is the *only* way of achieving maximum stability and most positive, accurate control with minimum stress on working parts at today's sub-sonic to supersonic speeds.



As the leading supplier of heating and temperature control equipment for the transportation industry, Vapor maintains the latest manufacturing methods in its Chicago, Illinois factory—has strategically located engineering offices throughout the United States. Each office is staffed by competent sales engineers with many years experience in the application and design of temperature control equipment for transportation vehicles.

Vapor RADOR 'LECTRONIC MODULATES TEMPERATURES ALWAYS AT THE CONTROL POINT

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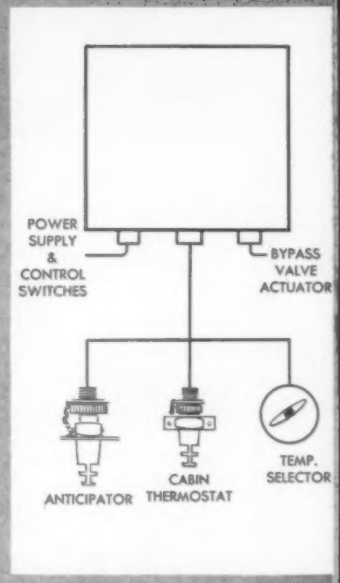
VAPOR HEATING Corporation

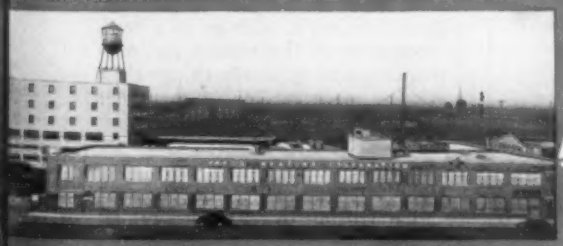
IN AIRCRAFT TEMPERATURE CONTROL

CONTROLS TAILOR-MADE TO MEET SPECIFIC REQUIREMENTS...

...From the low cost, complete simplicity of Vapor's basic Mercury Tube thermostat temperature control system to the most accurate, lightest weight, fastest compensating *Electronic* System—Vapor engineering offers a complete range of control systems, each applying the advancement of Smooth Pulse Modulation through current applied intermittently to the actuator. The anticipating action (completing and interrupting the contact circuit) results in Smooth Pulse Modulation.

Vapor alone permits a choice between the proven accuracy of light weight, low cost mercury tube control and the new Vapor Electronic control—each designed to establish the highest degree of accuracy, rapid response to temperature change and "Smooth Pulse" action on valves and actuators that insures long life. With Vapor each component part is tailored to the job. Let Vapor plan your next Temperature Control Program.





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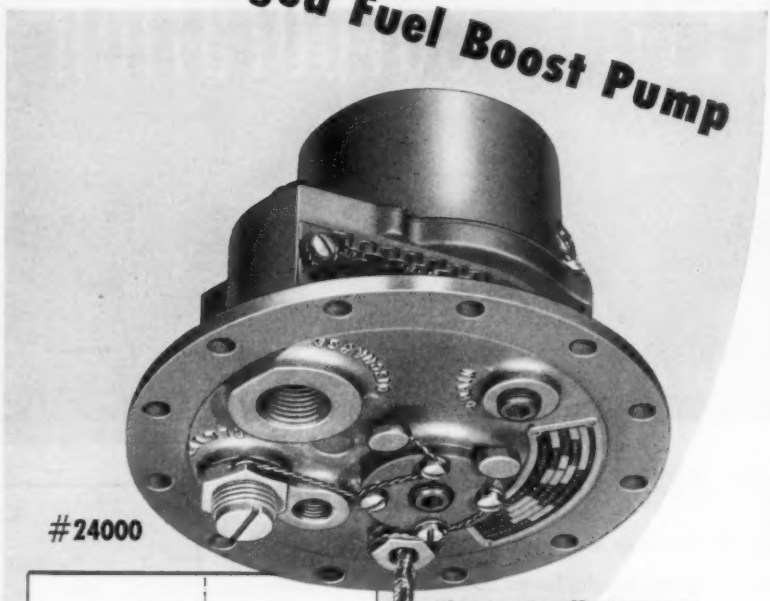
NEW ADEL
Submerged Fuel Boost Pump



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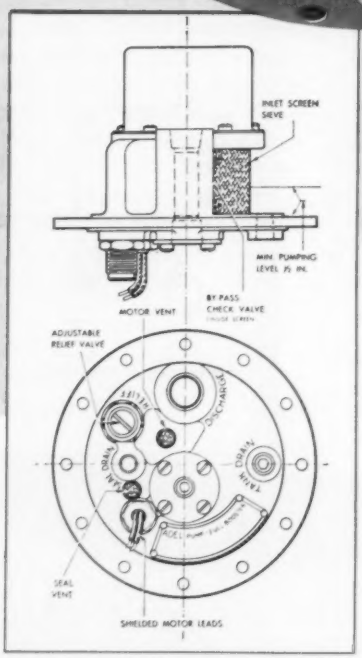

They're Small, Compact
They're Lightweight
They're Dependable

Impeller type pump, designed, and fills the need, for a submerged fuel boost pump for smaller Aircraft and Helicopters.

PERFORMANCE CHARACTERISTICS

DUTY: Continuous.
OUTPUT: 40 g.p.h. min.
DISCHARGE PRESSURE: 11 p.s.i.g.
D. C. VOLTAGE: 24 & 12.
CURRENT: 2 & 4 Amps.
AMBIENT TEMP. RANGE: −65°-+160°F.
WEIGHT: 2 lbs., 7 oz.
SIMPLE CONSTRUCTION.
Integral relief valve is adjustable between 3 & 12 p.s.i. and it limits shut-off pressure to a max. of 2 p.s.i. above pressure at rated flow.

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only air jobs France is capable of taking on right now—defense of French skies against enemy bombers, and tactical support of allied ground forces.

They admit that Vampires and Ouragans couldn't stop fast jet-propelled bombers. But they don't expect the Russians to have enough such bombers to count for much. And the proposed French Air Force interceptors could bring down the Russian imitation of the B-29.

Therefore the real questions are how many more planes, how much sooner, will the French Air Force need, within the Atlantic Pact framework, to keep pace with the accelerated Communist menace, and how many more can it get? These won't be easy questions to answer.

►**The Financial Problem**—Any call for more planes faster will mean wringing more francs from a reluctant National Assembly and from the hard-pressed minority of Frenchmen who don't evade their taxes. It's a sure thing, in any case, that the French will need substantial additional U. S. financial assistance if they are to expand their present air program.

French airmen spell out the financial problem this way: The French budget provides about 200 billion francs for the air force this year, compared to the equivalent of about 6000 billion which the USAF can spend and 500 billion which the RAF has to draw upon.

The French figure is about one-thirtieth of the American sum. But when one considers that the rickety and unjust French fiscal system makes possible about 30 percent tax evasion by official admission; that French national productivity is only about one-fourth that of the U. S., and that the country is just convalescing from the near bankruptcy caused by World War II, the two air force budgets become comparable in terms of national effort.

The limit of effective taxability, in other words, has just about been reached, without a thoroughgoing overhaul of the entire fiscal system.

Also, the French Air Force program, as its authors see it, adds up to a heavier burden upon the French economy in proportion to its ability to pay than that being made by any of the other Atlantic Pact powers in the aviation field.

Air power targets of the other allies should be raised before new increases are imposed on the French, airmen here think.

This tough problem will take many months of Allied conferences to thrash out. Meanwhile, the French aviation industry and air force are driving ahead full speed with their pre-Korean blueprint for rebuilding French air power.

►**Missions**—To be fairly assessed,

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this must be looked at against the background of the military mission in Europe assigned to the French Air Force within the Atlantic Alliance.

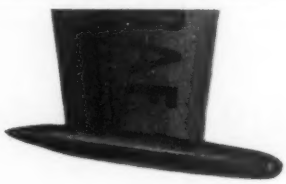
The mission is a dual one:

• **First**, the Fighter Command has been given the job of defending French airspace against enemy bombers, paratroop carriers, military transports, and their escorts. It also has the responsibility for weaving and manning the radar warning network along the northeastern defense perimeter to the Swiss border.

• **Second**, the Tactical Air Force will be responsible for helping to support Allied ground forces wherever it may be needed.

▶ **The Planes**—The Five-Year Program calls for the following planes to carry out these missions:

The Fighter Command now has 20 squadrons of Goblin-powered Vampire 5 jets, all but two squadrons of which have been imported from Britain. It has another 25 squadrons of miscellaneous World War II type fighters. As mentioned, a fleet of 224 more Vampires is being built under license in France to be powered with Goblins imported from Britain, and an order is slated to be placed soon for 210 more Vampires modified so that they can be fitted with Nenes made in France under license by Hispano Suiza.



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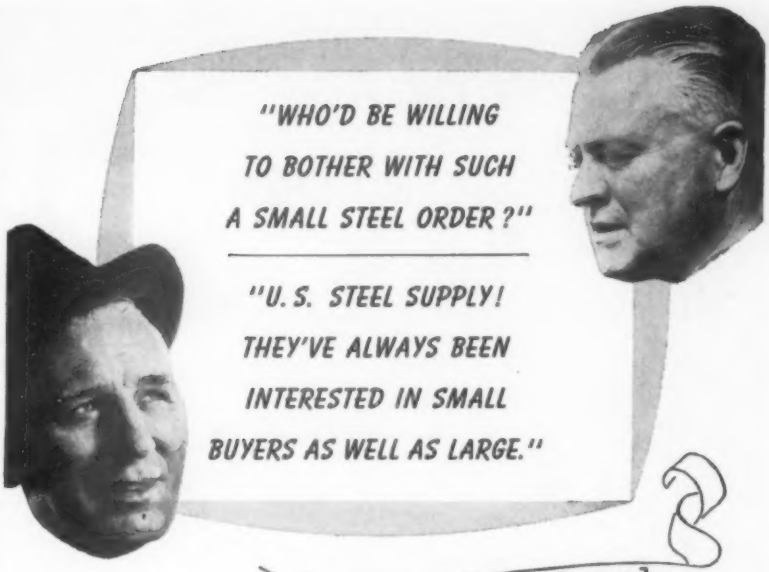
Modifying the Vampire to take the Nene jet turned out to be a knotty technical job involving redesigning the air intakes. But recent flight tests showed that the modified Vampire has a considerably better rate of climb, a much higher top-speed in level flight, and a slightly longer range. It also is fitted with an ejectable cockpit, unlike the earlier version.

The MD 450 Ouragans are due to start coming off the assembly lines early next year. The reason for ordering only 300 is that the Ouragan is destined to be the first of a big family of fighters; it is hoped that the improved versions will be coming up to take the place of the MD 450 soon.

The second version of the Ouragan —the MD 452, called the "mystery ship"—is due to begin flight tests early in March. Specifications still are under wraps, but it has a sharply sweptback, ultra-thin wing, and, unlike the MD 450, is a two-seater.

The first few MD 452s will be powered with British Tay jets—the British counterpart of the J48. Later, it is hoped that the Tay will be replaced by the French axial flow turbojet Atar, made by S.N.E.C.M.A., the French nationalized airplane engine company.

The Atar now is delivering in tests an average of 6000 lb. thrust, according to the French Air Ministry. It's ex-



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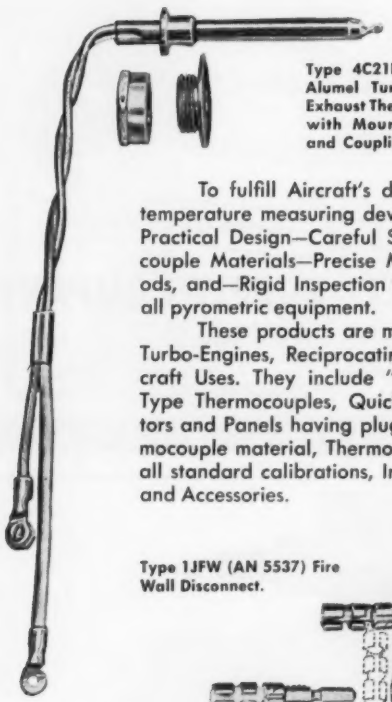

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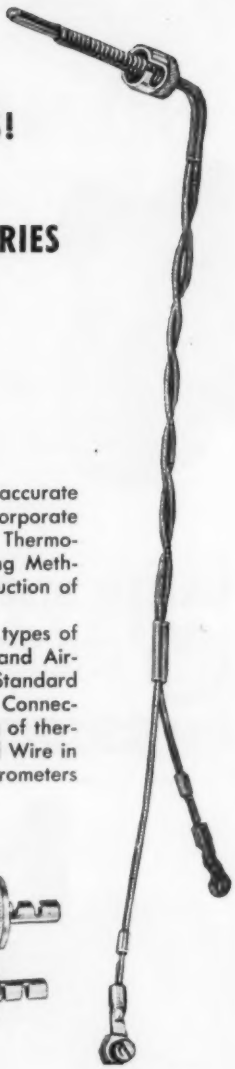

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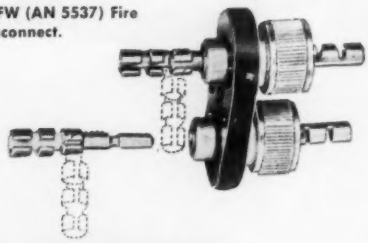

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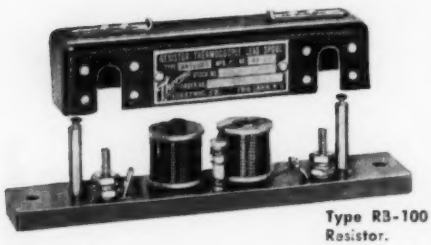

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pected to pass the 6500 mark soon and will be considered ready for service tests when it does. Tays and Atars will be delivered to combat units for comparative tests in MD 452s early next year if all goes well.

►**Night Fighter Needed**—Two night fighters—a light one and a heavy one—also will be ordered for the Fighter Command under the Five-Year Plan.

Odds are the first will be the de Havilland Venom built under license in France. This choice is likely because the fact that the French and British navies have adopted the carrier-based version of this plane would lead to considerable reduction in maintenance costs.

The French Air Force plans to have about 200 Venoms in service by 1953. But it desperately needs some night fighters—any kind of night fighters—right now. The French have asked for some night fighters either from Britain or the U. S. to plug the gap in their line-up while they're waiting for their own to be made. They'd be glad to get even World War II types for lack of anything hotter.

Hopes are high that the new SE 2420 will play the part of the heavy night fighter. First prototype of this plane is slated to fly before the end of this year. A prototype of an earlier version, the SE 2410, has flown about 20 test flights satisfactorily—although flights so far have been at relatively low speeds.

Specifications of both planes are top secret. All that is known is that the SE 2420 will be a 15-ton ship, with swept-back wings, a top speed of approximately Mach .9, a rate of climb of roughly 7900 fpm. It will be heavily armed and armored; be powered by two Nenes, Tays, or Atars.

How many of these planes will be built if the prototype performs satisfactorily will depend upon how much U. S. help in money and equipment is forthcoming, since it will be a very expensive ship to build. In any case, it couldn't be delivered to combat units in under three years.

The Fighter Command will depend on MD 450s equipped with special photographic apparatus for its reconnaissance, plus some special U. S. reconnaissance planes which it has been promised. What types the latter will be hasn't been decided.

►**Ground Support**—The Tactical Air Force would have to depend upon Vampires and Ouragans for ground attack missions should war break out within the next six months. But it is due to receive 100 F-84s within the next couple of months under MDAP, specialized for ground attack missions.

The Tactical Air Force, however, is counting on developing two good French ground attack planes for the future. One will be a special version of

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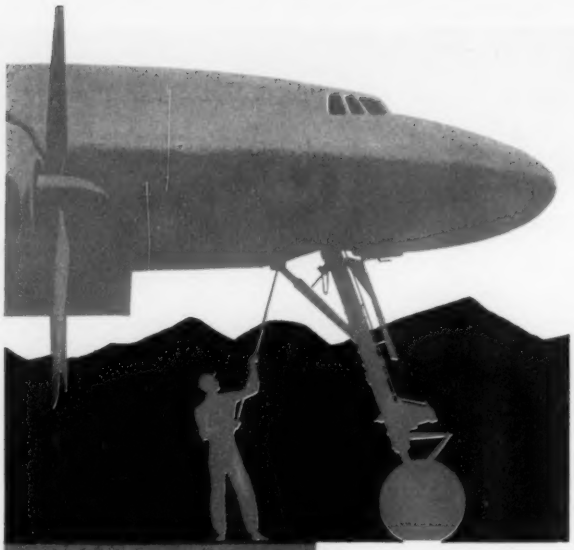

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the MD 452. The other will be a new plane, the Breguet 960.

The first prototype of this ship is due to fly within the next three months. It originally was intended for carrier operations, but it has been converted to a ground attack fighter. Specifications still haven't been revealed, and it is almost impossible to estimate its performance at this stage. However, it will have a turboprop engine in the nose for cruising and reconnaissance, and a Nene in the tail for attack.

► **The Trainers**—On the training side, the Air Force now is using SIPAs for beginning trainers, as they come off the assembly line; Morane Saulnier 472s, of which the Air Force has 500, as intermediate trainers; and Lockheed F80s and T-33s which soon will be given to France, as advanced trainers. The 240-hp. Morane Saulnier 730 will be put into mass production in the near future; it is designed to replace the SIPAs eventually.

For the future, the Air Force is pushing the development of a specially-designed training jet to be made by Fouga and powered by a specially designed jet engine being developed by Turbomeca. This may be the successor to Turbomeca's dual-flow Aspin jet which recently completed initial tests. But this plane won't be ready for production for at least another two years.

► **The Transports**—Two medium transports are being developed for the Air Force. One is the N2500 which just finished exhaustive tests fitted with British Hercules engines. One hundred and sixty of these planes are to be ordered; production should get rolling within the next few months; first deliveries are scheduled for mid-1952.

The N2500 somewhat resembles the Fairchild Packet. It performs excellently, carrying four tons 1000 miles at an average speed of 230 mph. The RAF is reported to be considering manufacturing the plane under license, and some French airmen hope even the USAF may eventually take an interest in it.

The second transport being pushed will be a larger military version of the Hurel Dubois HD 10. This small experimental prototype has performed remarkably during tests. Its military successor will be a two-engine plane with roughly the same carrying capacity as the Dakota. But its ultra-high aspect ratio wing should make it possible to equal or better the Dakota's performance using 700-hp. engines instead of 1100-hp. engines. And landing and takeoff runs are expected to be cut to less than 800 ft. The French believe the Hurel Dubois will be an ideal assault troop carrier. Two military prototypes are under construction.

► **The Ramjets**—In the experimental field, the French Air Force is pushing

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■ **Names like Chance Vought** Aircraft, TEMCO (See thumbnail sketch, this page), and Luscombe indicate the manufacturing activity. Chance Vought (building Navy Corsairs and jet Cutlasses) is now working some 6,000 employees on a constantly rising employment curve.

Within 40 miles of Dallas, too, the B-36s are being built (some 25,000 people employed at Consolidated Vultee). Combined aviation payroll for Dallas and the adjoining metropolitan area is doubtless well over $100,000,000 a year.

■ **Joining the Dallas parade,** Pioneer Air Lines, a regional operation, moved to the city in 1950. This line's president, Robert J. Smith, is on leave in Washington as vice chairman of the National Security Resources Board.

Flight Magazine, published in Dallas, surveys the aviation scene from this Southwest vantage point. Its publisher, George Haddaway, is a prime mover in the cause of civil flying. As chairman of the national Aviation Development Advisory Committee, this Dallas man is actively pursuing the proposition that private flying must be preserved through any emergency as a potential "non-military, non-airline airlift."

As a footnote to Dallas' air-mindedness is its role as a soaring center. The National Soaring Contest was held at Dallas last summer; president of the Soaring Society of America is a Dallas man (Jon D. Carsey).

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TEMCO *(Thumbnail sketch of a Dallas aircraft industry)*

By Julian Stag

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Today's scene is reminiscent of the days when North American employed 40,000 workers at the 1944 peak. This Dallas plant, with locally recruited help, achieved industrywide records for production efficiency.

Under TEMCO management now is the reorganized Luscombe Airplane Corp. at Garland, Tex., just outside Dallas. Here, production on the Silvaire personal plane has given way to subcontract work on B-36s. About 250 people are at work.

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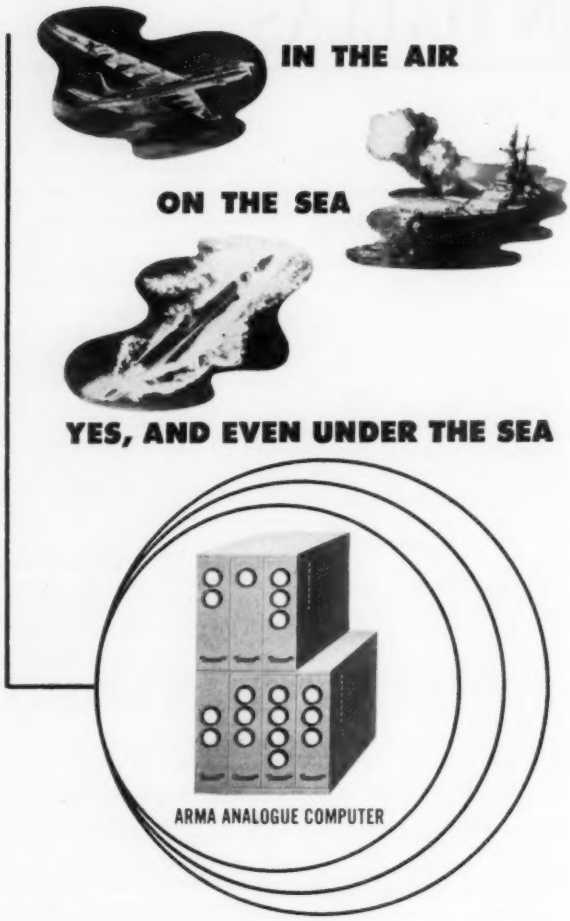

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the Leduc ramjet hard. Inventor Rene Leduc has been awarded a 500-million franc subsidy by the air force this year to speed development of the plane. French airmen are convinced that the ramjet holds the secret of practical supersonic flight under 80,000 ft.

Leduc's second prototype is slated to fly within a month. It is equipped with two small auxiliary turbojets under the wing tips for takeoff and for landing approach.

Design of the third Leduc ramjet are well advanced. It is to be a genuine supersonic aircraft. French officials estimate that it will have a rate of climb of more than 19,600 fpm.

The air force hopes that the Leduc supersonic version will be in mass production by 1954. Eventually, it is hoped that all French interceptor fighter units will be equipped with Leduc ramjets.

► **The Summing-Up**—That's the list of planes the French Air Force has to work with. The Five-Year Plan calls for a total of 25 combat groups or about 1500 planes by early 1953. Roughly 300 of these will be MD 450s; 50 will be MD 452s; and the rest will be Vampires with a sprinkling of F-84s and F-80s. About 300 of the Vampires will be fitted with Goblins; the rest with Nenes.

In addition, the fleet of military transports is slated to total 500—300 MD 315s and about 200 N 2500s—and the air force will have about 700 trainers of all types by 1953.

The French Naval Air Force by the same date is scheduled to have 10 squadrons of Lancaster anti-submarine patrol planes and 12 squadrons of carrier based Venoms.

The air force expects the radar warning system along the northeastern defense perimeter to be in place by the end of this year. The whole of metropolitan France is slated to be blanketed by a defensive radar network by 1955.

Air force manpower, meanwhile, is due to climb from 70,000 now to 95,000 by the end of this year and to 120,000 in 1953.

By the end of this year the air force expects to have 11 squadrons of Vampires and six squadrons of F-84s ready.

Side by side with these increases in combat strength the Five-Year Plan calls for building the necessary airstrips; organizing the additional technical services; strengthening the reserve corps; streamlining and expanding training facilities for officers and men and so forth necessary to keep the squadrons flying. A lot of groundwork already has been done in these directions.

That's the outline of where the French Air Force stands today and of the line of development it plans to follow.

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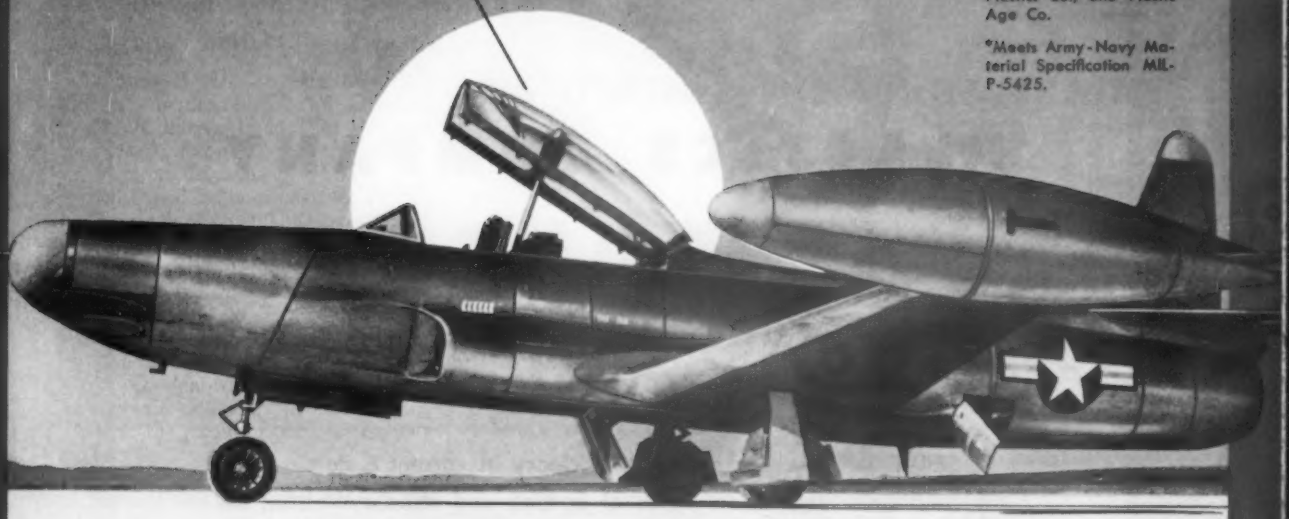

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TO SERVE with more speed and efficiency its current customers and the continually expanding needs of Eastern and Middle Western Industries, SWEDLOW PLASTICS CO. has now added a mid-western plant, as complete and modern in equipment and facilities as its West Coast plants.

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Canada

Lion's Share

RCAF will get major slice of Dominion's defense budget.

Toronto—Royal Canadian Air Force will get the lion's share of Canada's $5-billion defense budget for the next three years, according to Defense Minister Brooke Claxton.

RCAF will be boosted from its current strength of 18,000 officers and men to nearly double that figure, and will have 40 regular and reserve squadrons with more than 3000 airplanes additional to those now available to the air force.

With the RCAF plans now on the books, Canada will become the third ranking air power in the free world, probably the second ranking air training nation.

Of the 21 squadrons to be activated, all but one will be regular force, most will be fighter squadrons of 25 jet planes each.

Current strength of the RCAF is placed at 8 regular and 11 reserve squadrons. Regulars are made up of 3 fighter, 3 transport, 1 reconnaissance and 1 anti-submarine squadron. Reserve squadrons are mostly fighters.

It is planned to send an air division of 11 squadrons to Europe, with two fighter squadrons being sent immediately to join the one now overseas in an air wing.

Overseas squadrons eventually will be equipped with F-86E Sabre and CF-100 Canuck jet fighters both now being built in Canada.

► **Coordinated Plans**—These Canadian developments will be tied in closely with coordinated U. S.-Canadian planning for air defense of the continent, and with the overall air power needs of the North Atlantic Treaty Organization.

Canada last year set aside $300 million for aid in equipment and training for NATO countries. This has included equipping a Netherlands army division, as well as equipment for other countries.

In training at Canadian airfields at present are airmen of Belgium, Netherlands, Italy, France and Norway, and British airmen are expected to arrive in Canada for training in the very near future.

This follows the pattern of the Commonwealth Air Training Plan of World War II, when trainees came to Canada from all parts of the British Commonwealth and Empire. Army officers from all parts of the NATO nations and the

(*Continued on page 147*)

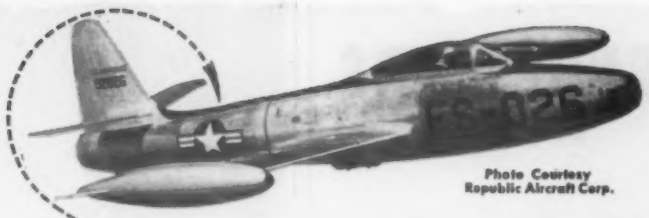
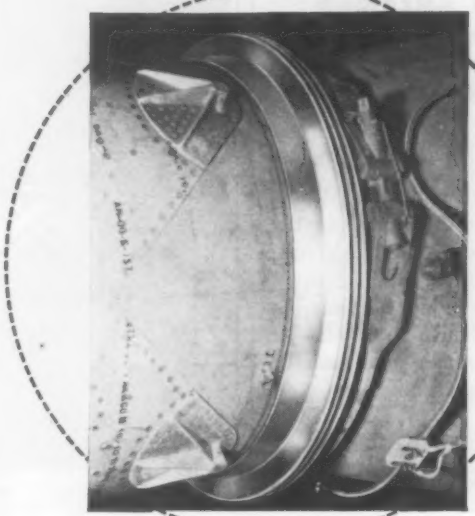


Photo Courtesy Republic Aircraft Corp.

HOLDING THE THUNDERJET'S *Breath!*



Smith-Morris makes *unusual* high temperature parts for jet and reciprocating engines. They process the exhaust bellows above *complete*, at war speed, with aircraft precision and quality . . . May we help you?

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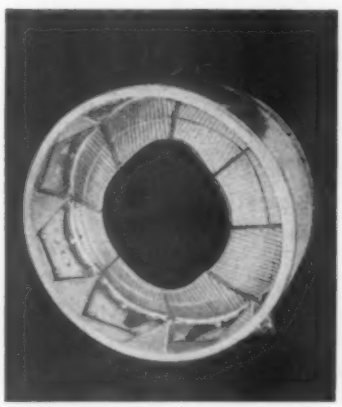
Retractable Screen for Jets

Combat aircraft must be prepared to fly anywhere—anytime. In no other service is all-weather flying ability so fundamental. The foe of the jet aircraft is ice. Tons of moisture-ladened air pour into its throat at freezing temperatures every hour. Extensive research has demonstrated that retractable debris screens are required for all-weather operation—and Smith-Morris is the pioneer designer and builder of retractable air inlet screens. Make use of our Screen Division's years of experience in this field.



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Long-range military program offers fine chance for establishing career in aircraft while aiding defense effort. Transportation to California and established training time. Salaries commensurate with experience and ability.

Please include summary of education and experience in reply to:

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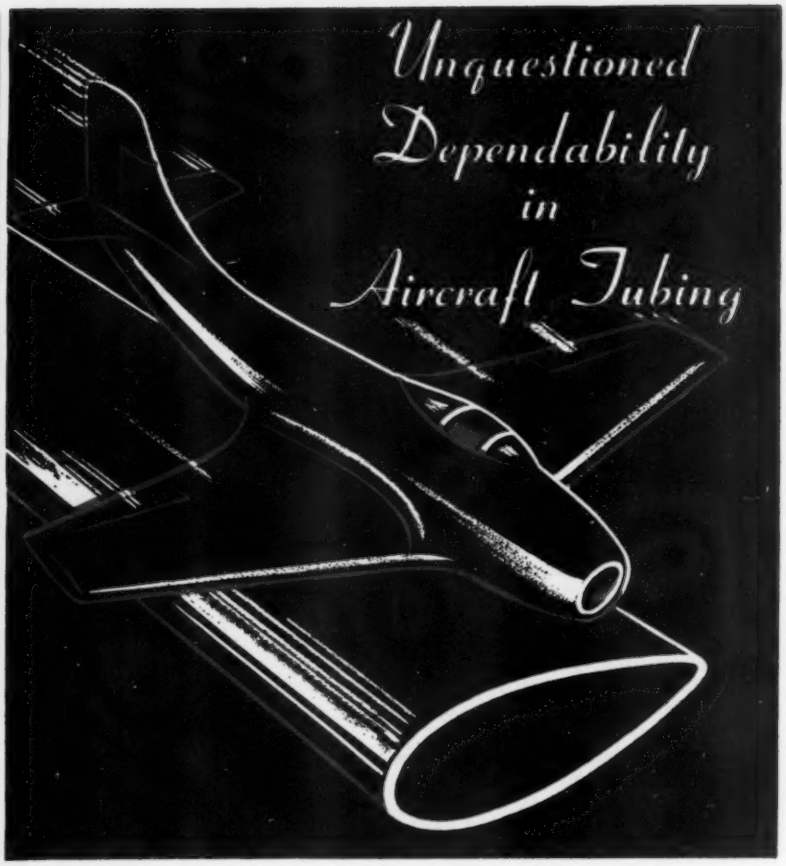

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Speed your production with a . . . finish that *meets exacting government specifications.* It's the Randolph finish—product of 18 years' experience and research.

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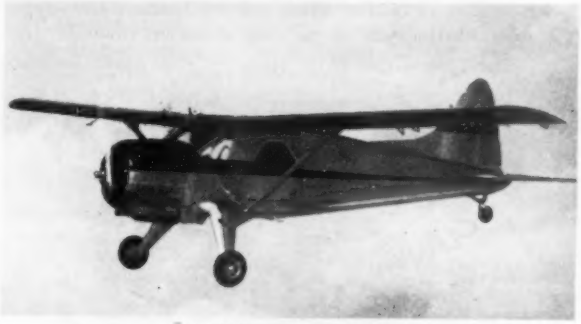


DH Beaver (Canada)

DH Chipmunk (Canada)

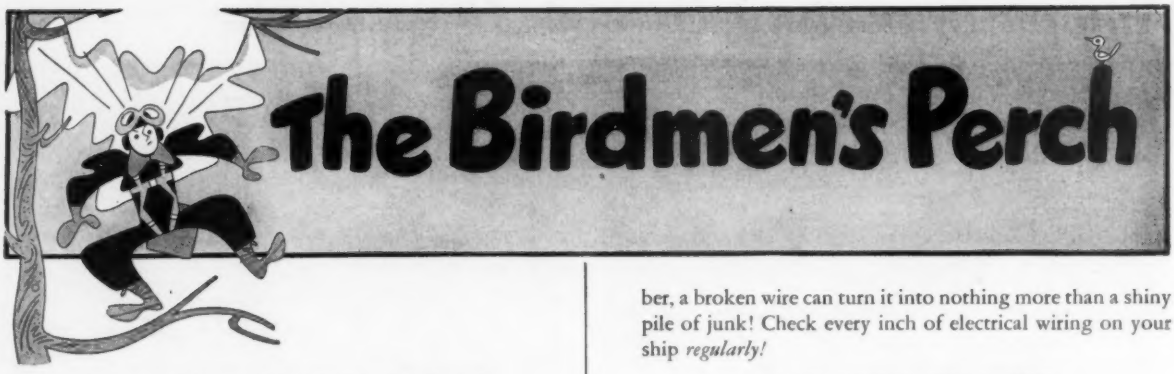
Saab 90 A-2 (Sweden)

Avro Canada CF-100 Canuck

Fokker S-11 Instructor (Holland)

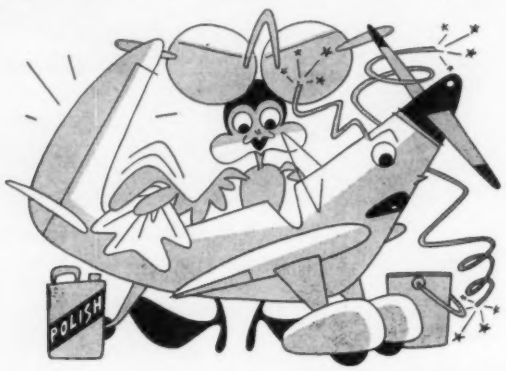
Saab J 21R (Sweden)

Saab J 29 (Sweden)



We've got our candidate for World's No. 1 Optimist!

He's the guy who figures his plane's electrical system will take care of itself. Yes sir—that joker will spend all day Saturday polishing up his paint job, but forget all about the fine-gauge wires that carry the juice from the battery or generator!



True, exposed wiring is usually insulated and fairly durable, but it won't last forever. Wiring, the best you can get, does break and does short! Beyond the usual dangers of fire from a short circuit, a broken wire can kill your prop deader than a herring!

Naturally, you don't want circuit failure in the air. The only answer is to learn proper circuit maintenance and practice it . . . on the ground!

A shiny ship is one thing—but remember, a broken wire can turn it into nothing more than a shiny pile of junk! Check every inch of electrical wiring on your ship *regularly!*

P-S-S-T, FERDIE, THE SCRIPT!

Attention, all aviators! Does your engine clank and scrape? Are the valves nervous, the rings sullen and irritable?

Then, Boys and Girls, those engines need Gulfpride

Aviation Oil—Series D—and no mistake! It's the finest detergent dispersant oil for horizontally opposed engines there is!

To wit, Gulfpride Aviation Oil—Series D—is the only aviation oil put through Gulf's exclusive Alchlor process to remove extra carbon and sludge formers!

Get hep and get engine-happy! Use Gulfpride Aviation Oil—Series D—exclusively and increase those periods between overhauls up to 100%.

GULF

AVIATION PRODUCTS

AT LOW ALTITUDES, WATCH OUT FOR STRUNG WIRES, OR ...
YOU MIGHT BECOME AMMUNITION FOR A SLINGSHOT, AND...
WASTE A TANKFUL OF THAT SUPERTERRIFIC GULF AVIATION GASOLINE!

Gulf Oil Corporation . . . Gulf Refining Company

British Commonwealth are also known to be taking training in Canada.

The air training program will be capable of turning out 3000 air-crew for Canada and other North Atlantic Treaty nations, and will cost in 1951 $64.5 million.

▶ **Radar Chain**—Coordinated plans for air defense of the continent, also announced by Mr. Claxton, would link American and Canadian radar chains together. The radar system being used has been only recently developed.

Meanwhile, RCAF is equipped with mobile radar, and Vampire and Mustang fighter planes. A special airborne Canadian brigade has been formed to offset the possibility of an enemy landing paratroops or seizing a Canadian airfield. This brigade was operating in connection with the 82nd Airborne Division in the United States.

▶ **Production Resources**—Canada is expected to build for Great Britain about 400 F-86 Sabre jet fighters, with Great Britain to supply the engines. Canadian orders for these planes now are understood to total 400. Planes will use American engines until Canadian production of its own Orenda engine gets underway. The United States is expected to purchase a number of single-engine Beaver freighter-reconnaissance planes developed since World War II in Canada. There have been some hints that Canada may even begin to build the British Canberra twin-engined jet bomber.

Since Apr. 1, 1950, the Canadian government has ordered aircraft totaling $330,494,153. Typical costs of items under this figure are:

- Twin-engine fighter: $750,000
- Single-engined jet interceptor: $400,000
- New airfield: $20,000,000
- Radar station and equipment: $6,000,000

While the number of supplier firms in the aircraft industry has been enlarged in the past year, main aircraft manufacturing plants are still located near Toronto and Montreal.

At Toronto, the A. V. Roe (Canada) Ltd., plant is now greatly enlarging its operations, and this year will have a staff of 10,000 at work on the Avro Jetliner, 50-passenger commercial or military transport; the CF-100 Canuck twin-engine all-weather jet fighter; and the Orenda turbojet engine.

The second Jetliner is now nearly ready for test flights, while the prototype has been busy making flights .n all parts of North America. The CF-100 is now in production. the first order for 10 given by RCAF having been considerably increased, though actual number ordered has not been officially announced. The Orenda turbojet engine is undergoing final tests and a new factory is now being built to make these

They meet Performance Standards with Flying Colors!

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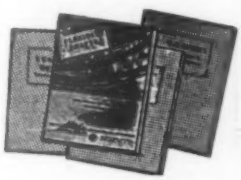
S.S.White's policy of combining quality materials and expert workmanship with expert engineering cooperation is your assurance of getting performance-proved products made to give the finest service. So, when specs call for flexible shafts, actuators, adapters, or pressure bulkhead fittings, remember, "S.S.White makes it right".



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Bulletin 5008 **has the latest information and data on flexible shafts and their application. Descriptive material on other products also sent on request. Write stating your requirements.**

THE S.S.White INDUSTRIAL DIVISION
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Systems Engineering

Guided missiles experience aids Martin in implementing this airplane design concept

Guided missiles were the first aircraft to attain supersonic speeds—the first to acquire fully automatic control—and the first to require the close design integration of components which The Glenn L. Martin Company calls *Systems Engineering.* Today, with piloted airplanes also passing the sonic barrier and being assigned increasingly difficult missions, it is essential that they, too, be designed as integrated air-borne systems, not merely as flying vehicles whose sole goal is speed.

With a background of demonstrated accomplishments on top level missiles projects and continuous growth in this field, The Glenn L. Martin Company has carried over *Systems Engineering* from its missiles experience to its airplane designing. The Martin engineering staff has been shaped and manned to provide proper emphasis on all three of the basic types of functional elements involved in the production of a modern airplane —airframe and power plant—electronic flight and navigational controls—and military armament or passenger facilities.

Martin Systems Engineering recognizes that the immediate problem of aeronautical engineering is not to concentrate exclusively on airframe performance, but to integrate the necessary electronic and mechanical systems into the airframe design to produce a truly effective military weapon. And, whether the weapon is a manned airplane or a guided missile, it is imperative that the complete development be so scheduled that the end product represents a completely coordinated system. There is no advantage in having an airframe ready for flight testing while the guidance system, which may necessitate airframe changes, is still a gleam in the designer's eye.

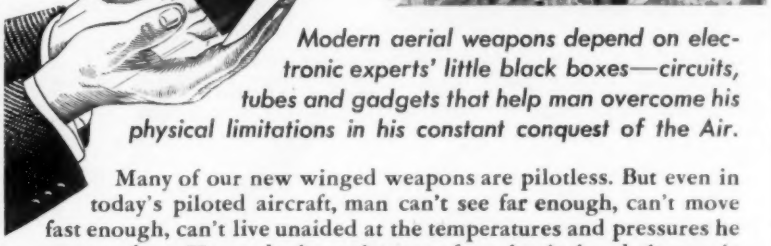
That is Martin *Systems Engineering.* That is why radar, servo-mechanism, automatic control, automatic computer and antenna experts—as well as aerodynamicists, structural engineers and electrical, hydraulic, armament and power plant installation specialists—are all part of the well-integrated engineering team The Glenn L. Martin Company offers its customers today.

Martin Ads Tell Air Power Story

Reaching millions of informed, alert American magazine readers, Martin advertisements like this one highlight air power's important role in our country's preparedness program. And survey after survey has demonstrated that their fiction-style appearance attracts an extremely high readership.

The general public and business circles are reached through the pages of *Time, Newsweek* and *Business Week.* The men and women who write and edit the news are kept abreast of latest developments through *Editor & Publisher, American Press* and *Publisher's Auxiliary.*

They're putting wings on little black boxes



Modern aerial weapons depend on electronic experts' little black boxes—circuits, tubes and gadgets that help man overcome his physical limitations in his constant conquest of the Air.

Many of our new winged weapons are pilotless. But even in today's piloted aircraft, man can't see far enough, can't move fast enough, can't live unaided at the temperatures and pressures he must endure. He needs the assistance of mechanical and electronic senses, muscles and nerves. That's why today's aerial weapons engineering demands a teaming of specialists in skills unheard of a decade ago.

Here at Martin, we call it *systems engineering.* Airframe and power plant, electronic flight and navigational controls, military armament and passenger facilities—all are represented on a Martin engineering team that is designing aircraft as integrated airborne systems.

A Navy Viking high-altitude research rocket, missiles and target drones soaring into the blue. An Air Force XB-51 jet-powered ground support bomber roaring down in a simulated strafing run. A Navy P5M-1 Marlin being readied for sub-hunting duty. A dependable Martin Airliner gaining precious time for vacationist and businessman. All these are products of Martin *systems engineering* — part of a new trend in aeronautical designing that is putting wings on little black boxes — to help man overcome his physical limitations — to help him guard the peace and enjoy it.

THE GLENN L. MARTIN CO.,
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Martin
AIRCRAFT
Builders of Dependable Aircraft Since 1909

Developers and Manufacturers of: Navy P5M-1 Marlin seaplanes • Navy P4M-1 Mercator patrol planes • Navy KDM-1 Plover target drones • Navy Viking high-altitude research rockets • Air Force XB-51 experimental ground support bombers • Martin airliners • Guided missiles • Electronic fire control & radar systems • Precision testing instruments • **Leaders in** Building Air Power to Guard the Peace, Air Transport to Serve It.

engines for all Canadian jet aircraft. The engine was jointly developed by the Canadian government and the A. V. Roe organization.

▶**Chipmunk and Beaver**—At Toronto also is de Havilland Aircraft of Canada Ltd., which is making the Chipmunk trainer, a postwar-designed, single-engine craft, for the Canadian as well as foreign governments. Its postwar Beaver freighter has been sold commercially in Latin American countries and Canada, and a number have been ordered by the United States Air Force, with possibility of a big order not ruled out yet. Both de Havilland and A. V. Roe are also reconditioning World War II aircraft which had been put in storage.

At Montreal, biggest plant is Canadair Ltd., now producing the F-86 Sabre fighter for the Canadian government. An order from the RAF is expected and may be paid for by Canada as part of its commitments for NATO countries. There have been reports that the Canadair plant will also build the F-86 for the United States government and for other NATO countries. The plant is also overhauling wartime aircraft and servicing its DC4M North Star aircraft.

Canadian Car & Foundry Co. Ltd., at Montreal, has no new aircraft in production at present, but is overhauling Harvard trainers. There has been some talk of the company's opening its Fort William, Ont., plant—where Hurricanes and Helldivers were built during World War II—to make a new version of the Harvard trainer. The company was at one time expected to make the Fairchild Packet in Canada, but this deal seems to have been deferred.

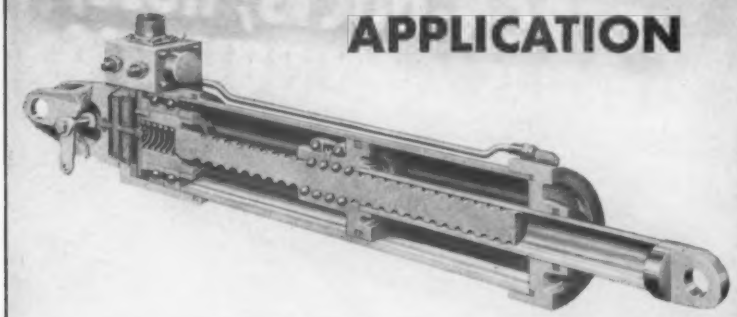
▶**Airline Expansion**—In civil aviation, the government's Trans-Canada Airlines has expanded its domestic operations as well as its routes to the United States in the past year, and is operating domestically at a profit. Its trans-Atlantic and Caribbean services are not being operated at a profit, but are being expanded, with service to Paris to start this spring.

British, Netherlands, French and United States airlines now operate to Canada in the international field.

Canadian Pacific Airlines has begun operations in the past year to Australia, New Zealand and to Hong Kong, expects to have its first British de Havilland Comet jet transports for these runs early next year. Its domestic services in northern Canada and on inter-city feeder lines continue.

Smaller scheduled Canadian airlines and the many unscheduled and charter services are finding it difficult to operate profitably and to keep good personnel on hand with an increasing shortage of civil pilots due to RCAF and big airline recruiting. New equipment is needed to replace the war-surplus transports most of them have been operating.

NEW BALL BEARING SCREW APPLICATION



New Aircraft Actuator Uses Saginaw Ball Nut Screw

This advanced, hydraulic aircraft actuator owes its efficiency and lightweight to its quick-acting Saginaw ball bearing screw and nut. It operates satisfactorily under extremely high loads . . . features emergency power drives and synchronization for two or more units. In the event of system failure, a mechanical brake locks the actuator. Stroke and thrust are limited only by available flow and pressures.

Numbers show electro-mechanical actuator installations on Banshee jet fighter for (1) main landing gear door, (2) main landing gear, (3) wing fold, and (4) nose landing gear. Operating loads run from 1800 lbs. to 14,000 lbs. Strokes range from 8.4 in. to 19.53 in. All installations use Saginaw's friction-free ball bearing screw and nut.

FRICTION-FREE PRINCIPLE NOW AVAILABLE FOR UNLIMITED USES

The friction-free operation of the Saginaw ball bearing screw and nut brings new efficiency to numberless industrial operations. In many cases actuating efficiency is increased more than 90 per cent, while operating costs are reduced as much as two-thirds.

The Saginaw ball bearing screw and nut makes possible the use of smaller motor drives with less horsepower. It permits faster operation with less heat generated, and allows rapid forward or reverse action with minimum wear and friction. Compact design for simple lubrication; remarkably low maintenance.

SAGINAW DESIGNS EACH APPLICATION TO SPECIAL ORDER

Each application is treated as an individual design; Saginaw makes no off-the-shelf sales. Manufacturing facilities are geared to meet any desired production rate — large or small — and deliveries are scheduled to meet customer requirements.

Saginaw puts 38 years of gear building experience behind every product it makes; has one of the largest and most highly trained staffs of engineering, designing and manufacturing gear specialists in the country.

INSTALLATIONS FOR BALL BEARING SCREWS COVER EVERY FIELD OF INDUSTRY

Present industries using the product include aircraft, machine tool, automotive, farm machinery, boat building. It is widely employed in truck trailers, adjustable beds, lifting jacks and countless other actuating devices. Complete engineering facilities are available to give prompt attention to customer problems.

Saginaw
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General Motors Corporation, Saginaw, Michigan

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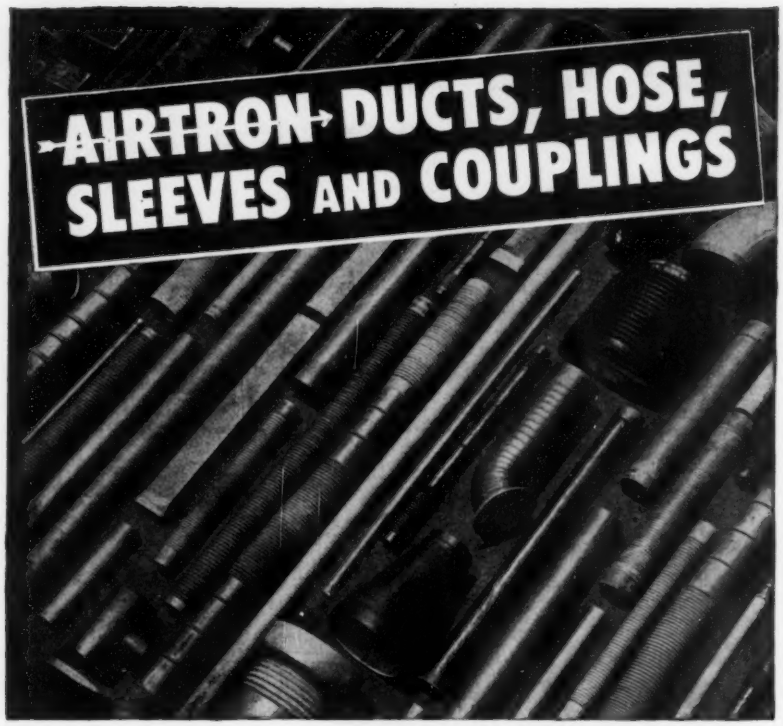

Fiberglas* aircraft ducting absorbs vibration, saves weight, is adaptable to a variety of applications.

Design engineers have specified Airtron in place of conventional ducting materials, on practically every U. S. airplane of recent design. Transport, bomber, fighter . . . jet, piston or turbo-prop, Airtron is used on them all. More than 130 standard constructions from which to select the *right* ducting, or it can be custom fabricated to the designer's specification.

Extremely Versatile—Five basic types and a variety of material combinations provide various degrees of flexibility and a wide range of operating pressures, working temperatures and resistance to vapors and fluids. Impervious to corrosion, odorless.

Extreme Temperature Range—Recently developed silicone rubber impregnated Airtron withstands temperatures from −100° to +600°F. Synthetic rubber impregnated types are designed for temperatures from −65° to +450°F. Both types meet aircraft specifications for fire resistance.

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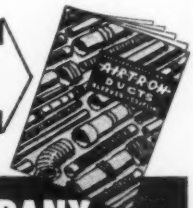
Complete engineering and descriptive data on AIRTRON is given in a new catalog now available. Get the full story on this useful material today.



*T. M. Reg. U. S. Pat. Off. by Owens-Corning Fiberglas Corporation

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DOWNEY, CALIFORNIA

"O" RINGS ★ SILICONES ★ PRECISION MECHANICALS ★ AIRTRON DUCTS

Australia

Aussies' Role

Commonwealth hope to be Empire arsenal due for disappointment.

(*McGraw-Hill World News*)

Melbourne—The contemplation of the destruction which atomic weapons might wreak on British aircraft plants and the bitter lessons of Asian aggression in World War II has ripened in the minds of Australian military leaders a new concept of Australia's role in British Commonwealth air defense.

Since V-J Day they have been trying to sell Britain on a plan to move her aircraft industry into the remote vastness of the Australian continent.

For good economic and technical reasons British aircraft makers have refused to report for the mass exodus. The reestablishment of British aircraft manufacture and ancillary industries would have required the transfer of almost as many people as there are now in Australia. Nothing could have pleased underpopulated Australia better, but British investigators who surveyed conditions down under found little else besides this immigration enthusiasm to commend the scheme.

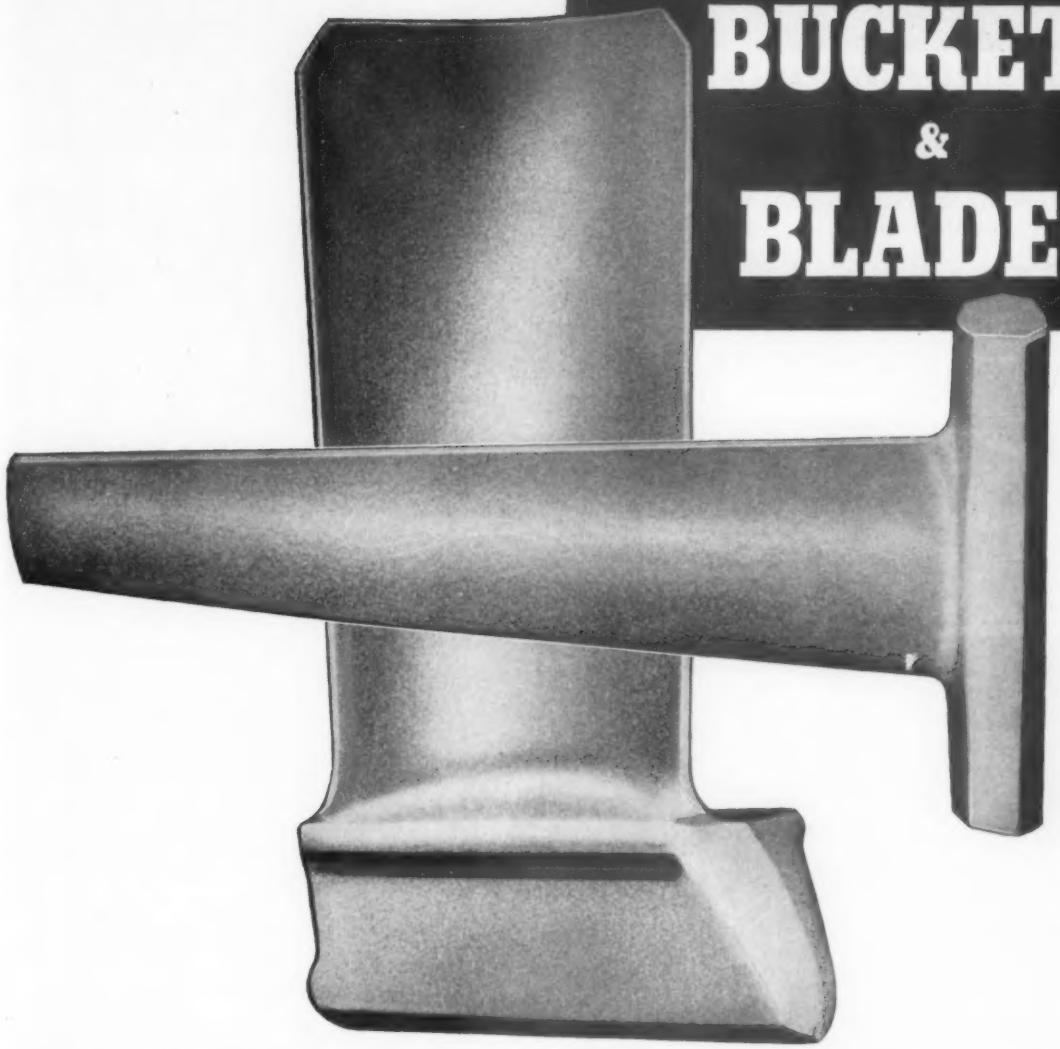
▶ **Will, But No Way**—They found that even minor foreign investment ventures were strangled by shortages of almost everything necessary to the establishment of manufacturing plants—housing for employes, building materials for factories, transport capacity, coal and electric power.

Before transplanting the British aircraft industry and its personnel, they would have been confronted with the preliminary task of opening up coal mines, building power stations, setting up brickyards and cement kilns, pushing harbor and railroad construction, and getting ships and rolling-stock.

What is left of Australia's own aircraft industry from the Second World War is facing the same thorny problems, though shortage of skilled labor is the most crippling handicap. After V-J Day, production was throttled down to a trickle and it was thought it was only necessary to step on the accelerator in a crisis to make it turn over full blast.

The crisis has been here since last June, but aircraft production continues to tick at little better than 1949 rates. In the twilight of mobilization and business-as-usual the industry is battling against overwhelming odds to wrest men and materials from civilian businesses. It has no plane in quantity pro-

BUCKETS & BLADES



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This is a specialized Utica skill . . . using close metallurgical control and modern equipment devoted solely to manufacture of these parts.

Utica makes possible the inherent strength of the forging method with tolerances held to a few thousandths.

Utica Drop Forge & Tool Corporation • Utica 4, N. Y.

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Makers of the famous
UTICA PLIERS & ADJUSTABLE WRENCHES

combustion engineering—in action—for air progress

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December 27, 1950

Surface Combustion Corporation
2375 Dorr Street
Toledo 1, Ohio

Gentlemen:

At the time we placed our Convair aircraft in service last Spring, we recognized the problem of inadequate cockpit heat and the need for heating the cabins on the ground; therefore, a decision was made to install "Janitrols", as we considered such an installation to be the most logical solution to our problem.

Since completing the installations in our fleet of Convairs, we have operated in temperatures far below zero, both on the ground and in the air, and have found the Janitrols equal to all occasions. Our Convair cockpits are warm and cabins may be heated to a comfortable temperature before boarding passengers, regardless of outside air temperatures.

In fact, the Janitrols can serve a third purpose in that there is sufficient heat available for both the cabin and cockpit, making it possible to use all heat from the normal source for anti-icing, should such action be desirable.

Yours very truly,

MID-CONTINENT AIRLINES, INC.

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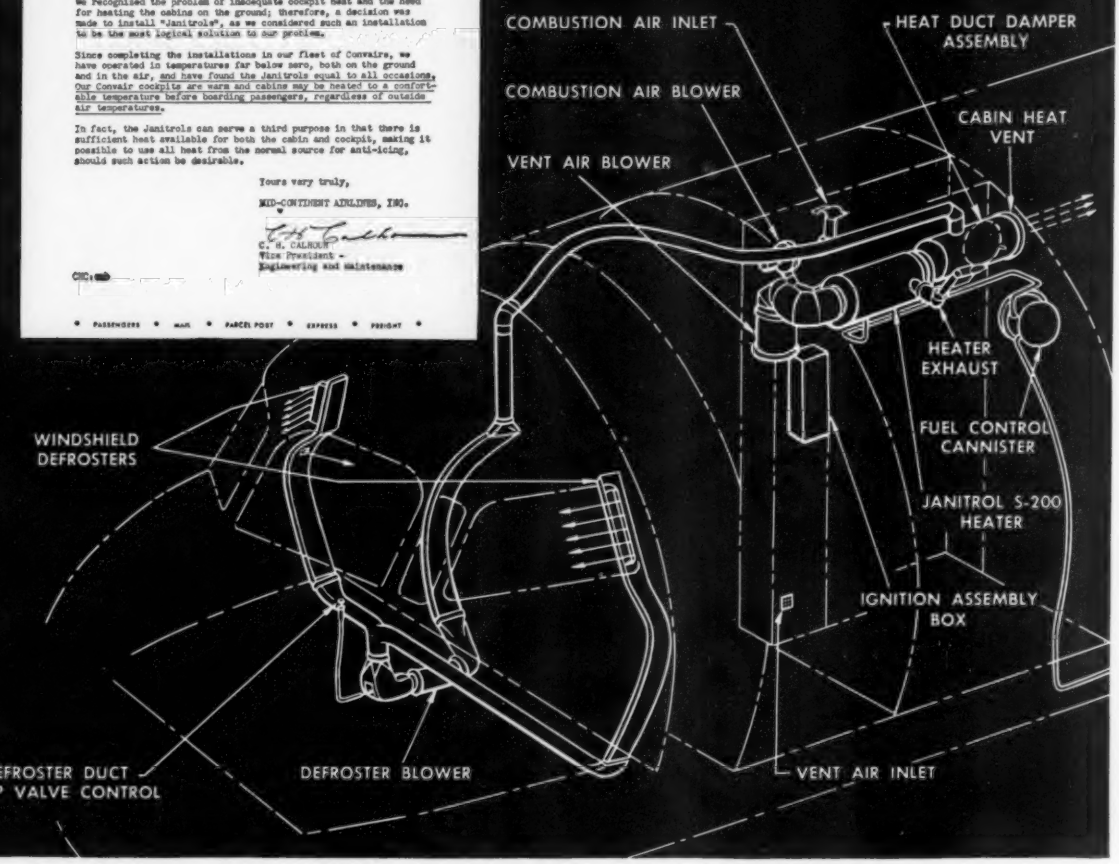

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duction which the Royal Australian Air Force could risk against Russian-built fighters. This at least relieves it of the usual rearmament dilemma over the choice of types. It has to start from scratch.

▶ **The Planes for the Job**—The Mustang fighter has acquitted itself well in Korea at jobs it can do. Australia has a jet fighter in production, the Vampire, and its powerplant, the 5000-lb.-thrust Rolls-Royce Nene. But although tooling for this project began early in 1947, the first Vampires were delivered only last year and there are probably not enough of them yet to replace the Mustang. As jet progress goes, the Vampire is already outmoded. Nevertheless, it will stay in production for a total of 80. Production of a more advanced powerplant, the Avon, is planned, but has not yet started.

The bomber situation is even worse. The Lincoln is the only bomber at present being built for the RAAF. Assembly of its replacement, the jet-powered Canberra, has not yet begun and it will not come off the assembly lines in quantity before the middle of 1952.

Australia is building no military transports though the need for them is acute. A trainer is still in the mock-up stage. Naval aviation is entirely dependent on British plants except for servicing and repair.

The only other plane of defense value built since the war is an experimental high-speed radio-controlled target aircraft designed by the British Ministry of Supply. And after years of production planning, the de Havilland branch plant in Australia has not yet been able to complete its first program of six Drovers, a small passenger aircraft for feederline service devoid of military significance.

To meet the immediate needs in Korea, the RAAF has gone shopping in Britain and the U.S. The Mustang squadron will be reequipped with 36 British-made Meteor Mark 8 jet fighters. The RAAF is also interested in the North American Sabre fighter and the Lockheed Neptune patrol bomber.

▶ **Hefting the Sabre**—It now looks as if the Sabre F-86 will also provide the answer to the RAAF's prayer for a fighter to replace the Vampire in domestic production. Ever since the Vampire began to take on the Model T look, the RAAF has been casting about for a better fighter, almost settling for the Hawker P.1081. However, because of the production experience and proven performance that is already behind the Sabre, the Commonwealth Aircraft Corp. is seeking the rights to produce this fighter for the RAAF.

It will possibly be powered with the R-R Nene until production gets started on the Avon axial turbine.

The question is how soon the Sabre

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can be pushed to the quantity production stage. In present-day Australia this is not merely a matter of cutting back civilian production in competitive industries by a few percent. Nearly all engineering industries are 50 percent short of everything, even without yet feeling the government ax. Typical delivery delays are three years for Australian-built automobiles and machine tools, four years for aviation electronic equipment and installations, five years for factory structures.

It would take something akin to all-out industrial mobilization to give the aircraft industry what it needs to get the latest plane types into quantity production before they collect vintage. So far the government has not decided on anything so drastic. The plane production program may, however, be speeded up by initial reliance on American and British components.

▶**Arms and the Men**—The RAAF personnel program is tailored to fit the slim Australian manpower supply. Under a plan which is to reach maturity in mid-1953, 5000 men are to be trained each year. During the first twelve months only 3000 men will be enlisted for training. The first quota of 750 will be called up in April for a training period of 176 days. There will be six groups of trainees, including tradesmen, administrative personnel, operator trainees, domestic service staff,

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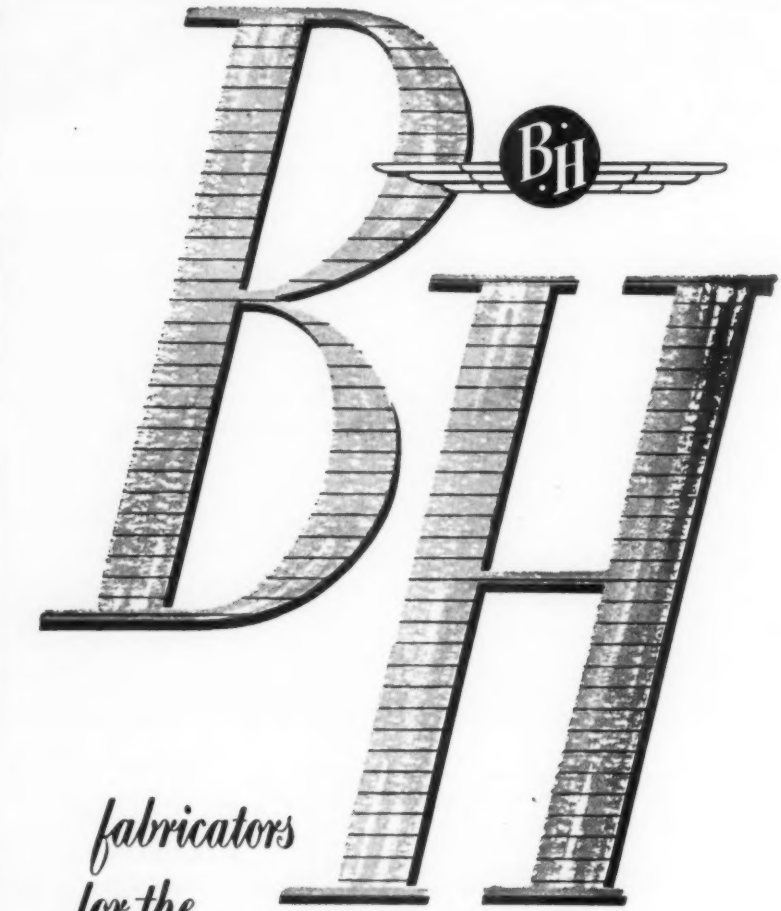

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FARMINGDALE, NEW YORK

general trainees and aircrew trainees.

It is obvious that at the moment Australia could not make much more than a token contribution to the air strength of the democracies if Communist aggression spills over from behind the Iron Curtain. But Australia will throw in everything she has if Britain does the same. And there will be no waiting for the bugle call from Britain, if the fighting lines in Asia move closer to Australian shores.

Australia's refusal to recognize Red China and her snap decision to join the Korean scrap, point up the extent of Australia's community of interests with the United States as far as the Pacific area is concerned. Deepening of the Far Eastern crisis would quickly set in motion Australia's mobilization machinery and probably bring a call for American material, technical help.

Sweden

Increases Asked for Stronger Air Power

(McGraw-Hill World News)

Stockholm—Viewed from this observation post, the small power appears more and more of an anachronism. Small countries cannot achieve the living standard possible with a large market—and adequate defense is right out of their way.

Even a country like Sweden—with considerable natural wealth and a developed industry—faces a practically insoluble problem. So, given their choice, Swedish military leaders would vote for joining the West tomorrow. But the country's Socialist government is obstinately sticking to neutrality.

No convincing reason for following this course has ever been given. As Socialists, government leaders tend to be ideologically neutral between East and West. They also like to nurse the illusion that the present struggle is just another big-power conflict.

▶ **Neutrality Weakening**—Until recently the Socialists have been able to maintain another illusion—that the nation was largely united on foreign policy. But mounting opposition, stemming from the official attitude on China and Korea, has made them patently nervous. The whole neutrality build-up is threatened with collapse.

The Socialists hold power, however. Accepting the situation, the opposition parties are pressing the government at least to see to the country's defenses. For the air force, they urge bringing all ten day fighter groups up to full strength—from 45 to 70 planes each. Four groups are still below strength.

▶ **The Strength**—In number of planes, Sweden's air force is impressive—for a

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small power. Emphasis is heavily on fighters. Total fighter strength is now around 600 planes. Five daylight groups are equipped with Vampires. In addition, there are some Mustangs, and some Swedish-built jet fighters. Production of 500 Swedish-designed 650-mph. J-29 fighters has hardly started at the SAAB factory at Linkoping.

Sweden has no strategic bombers. Five tactical ground support groups are equipped with Swedish jet fighters and Swedish light bombers built during the war. Two reconnaissance groups use Spitfires (Mk. XIX) and twin-engine bombers.

► **The Weakness**—Lack of all-weather fighters is a dangerous weakness—particularly with North Europe's climate. The Swedes have only one night fighter group, consisting of 45 aging Mosquitoes.

There seems some chance, though, of obtaining de Havilland Venoms (using Swedish-built engines).

Lack of experience in bad weather is such a serious deficiency, though, that Swedish army spokesmen claim the air force is grounded every third day—one officer asserting that combined operations have to be called off four out of five times.

—G. Howard Smith

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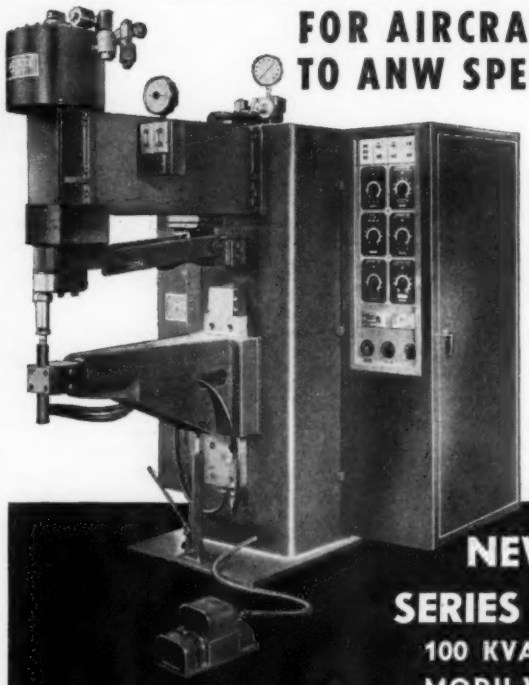

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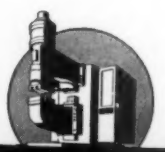

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Spain

Wartime Role to be Unsinkable Carrier

(*McGraw-Hill World News*)

Madrid—Spanish aviation as a fighting force is practically non-existent today. But a high Spanish officer sums up Spain's importance to the air power of the west:

"In case of war, planes can be purchased or leased; but air bases take time to be built and the role of Spain must be principally a formidable unsinkable aircraft carrier between the Mediterranean and the North Atlantic."

In this respect, Spain has put on a good show. Totally out of proportion to the size of her actual air fleet, Spain already has a net of airports that could be immediately used by a trans-oceanic fleet as European bases.

► **Airfields**—There are three major airports on the peninsula, Madrid, Barcelona and Seville. These fields can handle very large planes, including the B-36. In addition, Spain has two more bases with the same capacity, one at Las Palmas in the Canary Islands and the other at Villa Cisneros in Spanish Sahara of West Africa.

There are some 70 other small fields, both in Spain and in her possessions, which are used by the present Spanish military air force and the two Spanish commercial companies. Also there are many airports scattered over the country which were built during the civil war by the Italians, Germans and Russians and now, though abandoned, could easily be put back into use.

As for the communications, all Spanish planes use CW even within the country and must actually navigate their course during a flight of some 150 miles between Spain's two principal cities (Madrid and Barcelona) because the airport beams are not strong enough to meet. However, Spain recently installed two permanent "omni directional" console beacons at Seville and Lugo as a radio guide for planes passing by or through the country.

Spain's big asset to the western defense is the geopolitical position of the Iberian peninsula with a natural stronghold defended by a triple chain of mountains and a direct connection with Africa. Within this stronghold, the Castilian plateau can be considered as an immense and well-defendable airbase.

► **Planes**—But militarily, Spain's position is far less potent. Of its three armed forces, its air force is by far the least efficient. Since the Spanish Civil War, not a single military plane has been bought or built—except eight Spitfires acquired from the Allies' World

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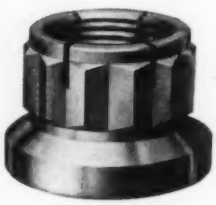

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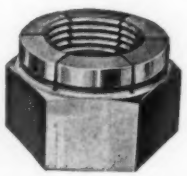

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War II surplus, and 43 Stinson 105s purchased last year from Consolidated Vultee for training and administrative purposes. The air force is composed mainly of relics from the civil war, and of a total of about 350 planes, 150 are grounded for lack of spare parts.

On the commercial side, there are two airlines: Iberia, the trans-Atlantic line, operating six DC-4s and 11 DC-3s; and Aviacion Commercial, the domestic line, with six Bristol 170s.

▶ **Airmen**—The personnel of Spain's air force amounts to 35,000 men and 4000 officers, of whom approximately 1500 are pilots and 105 are navigators, radio operators and bombardiers. The pilots are in a state of poor training due to the very small number of flying hours caused mainly by the shortage of fuel. Their morale, however, is excellent and their fight record during the civil war was considered very fine by foreign observers. Today, the general ability of the Spanish pilot can be considered good, as shown by the no-accident record set by Iberia during 1950.

It is considered by U. S. observers here that an intense period of from six to eight months training will be necessary to make full use of the 1500 military pilots that Spain actually has under the flag. This number could be increased by the some 100 commercial pilots, who are reserve officers presently working for the two Spanish commercial lines.

Holland

Dutch Aim Is 10-Fold Air Power Increase

(*McGraw-Hill World News*)

Amsterdam—Dutch air power expects to continue in 1951 the two-pronged expansion which was well underway in 1950.

• **Fighting power** has increased. New squadrons have been added and equipped with modern material. An eight-to-tenfold increase is expected by 1954, when 21 fighter squadrons should be operational.

• **Production facilities** are humming. Fokker Aircraft Factories are now actively engaged in turning out 300 Gloster Meteors—half for Holland, half for Belgium. Although some parts are now imported, it is planned that Fokker will take over complete production except for engines. Fokker is also building 25 Sea Furies.

In addition to the Meteors, Dutch air power will soon be augmented by the transfer of some 50 to 100 Thunderjets from the U.S. The U.S. has already presented Holland with 28 Beechcraft trainers to replace the Anson trainers

now used. Moreover, Fokker S.11s are replacing Tiger Moth trainers.

Airbases have been expanded and modernized. Trainee-pilots numbered 200 at the end of 1950, part of them training in the U. S. and Canada. Dutch air strength is now about 10,000.

When present expansion plans are fulfilled, Holland should have one transport squadron, and several artillery observation and reconnaissance squadrons in addition to its fighter strength.

Dutch aircraft production, now concentrated at Amsterdam, is gradually being transferred to Fokker's new factory near Schipol aerodrome. Employment is 2000.

Brazil

Trained Cadre is Value in Small Force

(McGraw-Hill World News)

Rio de Janeiro—As present constituted the Brazilian Air Force (Forca Aerea Brasileira or FAB) is of little world importance, consisting of obsolete equipment in small numbers. Its value lies in the cadre of trained men which would be available should either the need or the means arise to increase and modernize it.

Right now FAB consists roughly of the equivalent of a couple of squadrons each of F-47 Thunderbolt fighters, B-25 Mitchell bombers and C-47 transports. It also has a small fleet of C-45 Beech transport planes and a few OA-10 Catalina amphibians. Pilot training is conducted in Fairchild PT-19s and North American AT-6s.

On the ground it has a fairly comprehensive system of airbases, most of them built during the last war.

Manufacturing of aircraft or aircraft components is virtually non-existent. There is an AT-6 modification plant at Belo Horizonte and these aircraft also are assembled at other bases about Brazil. There are heavy manufacturing plants available which presumably could convert to aircraft production providing the special tools and fixtures could be obtained and specialized "know how" gotten from overseas.

▶**USAF Liaison**—Besides using all American equipment, FAB is very closely coordinated with USAF practices and techniques in virtually all fields of aviation. This work is carried out by an organization known as the Joint Brazilian-United States Military Commission, the USAF section of which consists of 100 officers and men under the command of Maj. Gen. Robert M. Webster. Gen. Webster was commanding general of ATC in 1946-47 and commanding general of the 1st Air Force 1948-1950.

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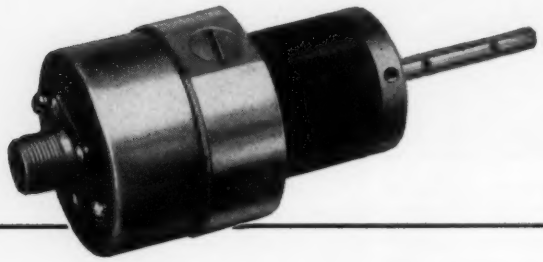

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sort of "efficiency expert" organization which makes available to FAB latest information on training and operations methods as used by USAF. At the top level it has liaison with FAB war planners, with the Air War College and the Air Command Staff School, and FAB's Aviation Medicine section.

The Commission has USAF officers and men stationed at a number of FAB establishments where they are on tap with USAF material and advice on the activities of each base. These bases include:

- **FAB's central service,** maintenance and depot base at Campo Marte Airbase near Sao Paulo.
- **Tactical Air School** at Cumbica Airbase near Sao Paulo.
- **FAB's "West Point of the Air"** at Camp dos Alfonsos, near Rio.
- **The two general air** technical schools at Sao Paulo and Guaratingueta.
- **FAB's air mapping,** weather and communications centers at Rio.

American air observers are well pleased with the recent appointment of Brig. Gen. Nero Moura as Minister of Aeronautics by newly elected President Getulio Vargas. Moura was commander of the Brazilian fighter group in Italy in World War II, and is regarded as a combatwise veteran familiar with American methods and generally as a friend of the U. S. Brazilian aviation is expected to make great strides under his leadership.

► **Bomber Training**—Another important project includes the early delivery, on loan, of six B-17 bombers which will be used in the training of FAB pilots, airmen and ground crews in four-engine operation and maintenance, as well as in advanced air mapping and in rescue work. American personnel will come with the planes to instruct.

Although Brazil's air force is demonstrably weak, it is the opinion of qualified observers that its quality is high, taking into consideration its equipment. Pilots are described as having a "real feel" and groundwork is termed good. These qualities were demonstrated during the last war when FAB sent an American-equipped fighter group to Italy and furnished all its own primary maintenance.

Whether FAB will again emerge as a combat force is a matter which rests with the politicians rather than the military. Certainly Brazil is a friendly nation and its leaders are strong in their affirmations of its close connection with the USA. But being far from any firing line that may develop in the near future, the country has no real feeling of the immediacy of war. Also, being a nation growing into its vast unclaimed interior zone (Brazil is a good bit larger than the continental USA) vital public works programs

claim so much of the treasury that there is little left over for important military expenditures.

Certainly the FAB would like to obtain and use four-engine transports and multi-engine and jet-engine combat aircraft—it has none of these now—but first the wherewithal must be found. Possibly, at some future date, this may come by means of foreign assistance. In the present context it appears unlikely to come any other way, in any significant volume.

Mexico

Poor Air Force, Small and Outdated

(*McGraw-Hill World News*)

Mexico City—An evaluation of where Mexican airpower would stand in case of future hostilities must take account of the following three facts.

• **In World War II,** Mexico entered a good fighter squadron on the side of the allies, and she could, and probably would, do so again.

• **Every aircraft** in the Mexican air force (250 in number) is obsolete at the moment.

• **Even if the U. S. supplied** up-to-date aircraft to Mexico, it would take a minimum of a year to re-organize and train the re-equipped fighter squadron or squadrons.

One of Mexico's top air force generals has said that Mexico's present military aircraft are "flying wrecks" and that the best planes they have are "third hand."

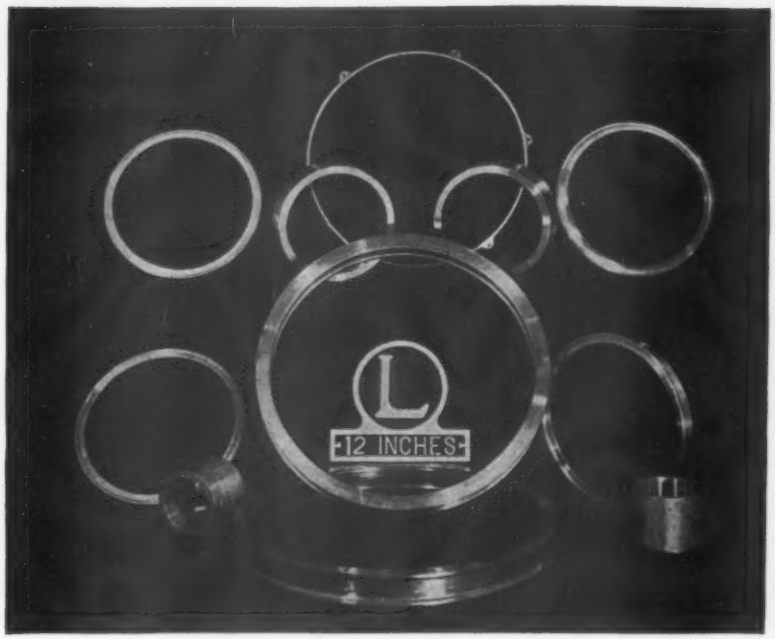
At present, Mexico's present air force consists of 250 planes of all types consisting of about 150 AT-6s, about 20 F-47s, and an assortment of C-47s, AT-11s, BT-13s, BT-15s, and PT-19s. All of these planes are obsolete and in poor shape.

Personnel of the Mexican air force consists of 3500 men, organized into four groups containing ten squadrons plus the 201st fighter squadron, a Pacific veteran outfit, which operates directly under Mexican GHQ.

They have four training schools, which turn out about 25 new pilots a year plus ground crews. Actually, the Mexican youths make good pilots, but lack of funds confines them to about four hours flying time per month which is entirely inadequate.

The general efficiency, condition of aircraft and equipment and operational competency is poor, due to Mexico's traditional dependence upon her ground troops as the all-important part of her armed forces.

Out of a defense budget of 275 million pesos (about $31 million dollars), the air force gets only 16 million or less than $2 million dollars this year. Thus



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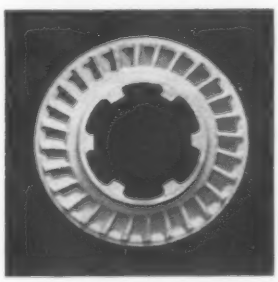

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the air force receives less than 7 percent of the military budget.

There has been talk of Mexico acquiring a hundred or so U.S. surplus P-51 fighters and medium bombers at 10 percent of cost. Nothing has come of this to date. But even this equipment is obsolescent.

If the U.S. sent new jet aircraft, instructors and ground equipment to Mexico, and if not only competent but extremely tactful liaison officers were permitted to operate with the Mexican air force, it might be that Mexico could acquire an up-to-date air arm in, at the soonest, one year's time, but probably two or more.

Norway

Steady Progress in Big Rebuilding Job

(*McGraw-Hill World News*)

Oslo—Progress has been made in the complicated job of rebuilding Norway's peacetime air defense. Although the nation has few of the varied behind-the-lines services needed to maintain a modern air force and was hard hit by the wartime German occupation, it embarked some time ago on a comprehensive air program.

The program called for eight day fighter squadrons, two light bomber-night fighter squadrons, two reconnaissance squadrons, and one transport squadron. Squadron strength is about 20 planes.

Exact information is not available, but it is believed that this program has been completed and additional funds appropriated.

Fighter squadrons are gradually being equipped with Vampires, replacing Spitfires and Mosquitoes. Other operational craft in current use are Catalinas, Fairchilds and Harvards, as well as British Oxfords and Ansons, for training; and for transport and communications work, Lodestar, Junkers 52, Norseman and Fieseler Storch planes are used.

Italy

Aircraft Industry Making Recovery

(*McGraw-Hill World News*)

Rome—The breath of life is coming back into the Italian aircraft industry.

Only a few years after its total collapse, the once-proud industry is beginning to stir. Personal and training aircraft are being built in small series, equipped to some extent with native engines, propellers and instruments.

Even in the field of jet propulsion,

the Italians are making valiant efforts to regain some of their lost glory.

▶**Limited by Peace**—The Italian Air Force has been limited, by the terms of the peace treaty, to a total strength of 25,000 men and 350 aircraft. Of the aircraft, 200 can be defensive fighters, but the balance must be training and special-purpose planes. Bombers, guided missiles and some other modern defense weapons are expressly prohibited by treaty.

But organizational difficulties, piled on top of the war's destruction, have kept the Italians from even achieving their permitted strength.

Funds were not made available in sufficient quantity. Flying and engineering personnel have had little chance to gain experience and training in the postwar years. Very low pay rates have affected the quality and quantity of Air Force recruits.

▶**Production Low**—Total postwar aircraft production is estimated at no more than 200 planes; most of these were for export, very few for Italian government contracts.

Adding to all this is the apparent hesitancy of the Italian government to tackle aviation problems and to appropriate the necessary funds for adequate support of the aircraft industry.

But there is a brighter side, evidenced by the poetic lines of some recent Italian designs—the Macchi B.320, Ambrosini S.1001 and the Piaggio P.136—and the practical arrangements by which Italy will build British jet engines under license.

▶**Licensing**—In the licensing deals, Fiat and Alfa Romeo will build Ghost and Goblin motors to power Vampires which will also be made in Italy. The engine tooling is well underway, and production should be starting soon.

Italian technicians are well pleased with the virtual "shadow plant" deals which were arranged. They say the British are more understanding of their position than the Americans who want to supply everything, without consideration for Italian industry, Piaggio will be making the Lycoming engine, however.

Fiat is now working on a two-seater jet fighter of its own design, meant primarily for training purposes. This jet trainer—the G.80—was designed by Prof. Gabrielli. It will mount a de Havilland Goblin 4 jet in the fuselage center. Jet's static thrust is 3500 lb.

It seems, then, that without exceeding treaty limits, the Italians could:

• **Renew and standardize** their flying equipment.

• **Restore air bases** and ground facilities for NATO use in the Mediterranean.

• **Train a solid cadre** which could be the nucleus for a future enlarged air force.

SUPER DC-3

Photos: Courtesy Douglas Aircraft Company and United Air Lines

DC-6

UNITED 377

...all are equipped with the new Hartman 400-ampere high interrupting capacity cutouts

Modern wide speed range generators of large aircraft—designed to meet heavy load demands of electronic devices and other equipment formerly actuated by non-electrical means—pose unusually difficult control problems.

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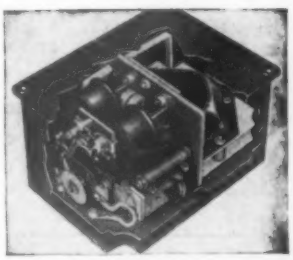
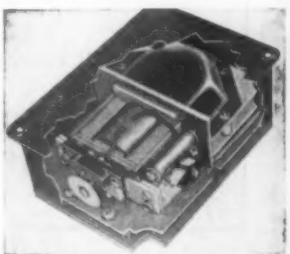


New Hartman 400-Ampere 28 Volt Reverse Current Cutout (A-750D)



New Hartman 400-Ampere 28 Volt Contactor for aircraft with panelized systems (A-751D)

the Hartman Electrical Mfg. co.

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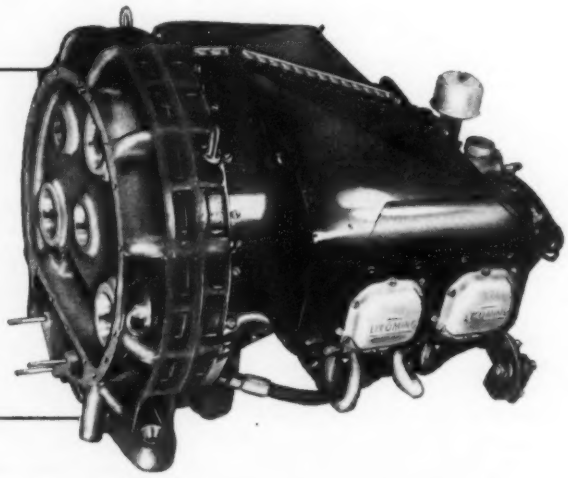

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Leading Foreign Jet Engines

Manufacturer & Address	Designation	Type	Compressor stages	Turbine stages	Performance—Turbojets: Static thrust @ S.L. (lb.)	Performance—Turbojets: At rpm.	Performance—Turbojets: Rated thrust (lb.)	Performance—Turbojets: At rpm.	Performance—Turboprops: Shaft hp.	Performance—Turboprops: At rpm.	Performance—Turboprops: Equivalent ahp. @ S.L.	Performance—Turboprops: At rpm.	Performance—Turboprops: Max. cont. cruising eshp.	Performance—Turboprops: At rpm.	Performance—Turboprops: At altitude (ft.) & mph.	Performance—Turboprops: Max. residual thrust (lb.)	Performance—Turboprops: Propeller reduction gear ratio	General: Fuel flow (gph.)	General: Specific fuel consumption (lb./hr./lb. thrust or lb./hr./ehp.)	General: Compressor air mass flow @ max. rpm. @ S.L. static, (lb./sec.)	General: Corresponding pressure ratio	Temperatures: Turbine inlet (deg. C)	Temperatures: Maximum tailpipe (deg. C)	Dimensions: Maximum length (in.)	Dimensions: Maximum dia. (in.)	Weights: Dry weight (lb.)	Weights: Total weight (lb.)	Equipment: Make starter supplied with engine	Equipment: Type starter supplied with engine	Engine time allowed between overhauls (hr.)	Engine status
AUSTRALIA																															
Commonwealth Aircraft Corp. Pty., Ltd. Fisherman's Bend, Pt. Melbourne	Nene 2VH	CFJ	1	1	5000	12,500	4000	11,800	....	.....	....	.....	.....	.....	.....	.....	.....	....	1.09	88	4.4:1	.....	745	96.8	49.3	1600[1]	....	Rotax	.....	200	IP
CANADA																															
A. V. Roe Canada Ltd. Malton, Ont.	Orenda	AFJ	*11*	...	*7000+*	.....	.....	.....	....	.....	....	.....	.....	.....	.....	.....	.....	....	.....	.....	.....	.....	.....	*135*	*42*	.....	.....	.....	.....	.....	IP
ENGLAND																															
Armstrong Siddeley Motors Ltd. Parkside, Coventry	Adder [12]	AFJ	10	2	1050	15,000	....	.....	....	.....	....	.....	.....	.....	.....	.....	.....	140	.90	17.6	5:1	867	590	42.30	28	.....	550	Rotax	Elec.	.....	....
	Mamba ASM3	AFP	10	2	.....	.....	.....	.....	1320	15,000	1476	15,000	1270	14,500	SL/300	405	.0845[3]	135	.73	18	5:1	877	580[4]	57.83	29	.....	780	ASM[5]	Air	.....	....
	Double Mamba ASMD1	AFP	10	2	.....	.....	.....	.....	2640	15,000	2951	15,000	2520	14,500	SL/300	810	.0964	270	.73[6]	17.6	5:1	877	580[4]	79.83	32.8[7]	.....	2000	ASM[6]	Air	....	SC
	Python 1	AFP	14	2	.....	.....	.....	.....	3670	8000	4112	8000	3260	7600	SL/300	1150	.135	355	.69	52.5	5:1	.....	590[4]	96.77	54	.....	3350	ASM	Air	....	IP
	Sapphire ASSa3	AFJ	*12*	*2*	7220	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	....	.916	.....	*7:1*	.....	.....	140.15[8]	35.25	.....	2500	.....	.....	....	IP
	Viper AV2[10]	AFJ			1575	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	....	.....	.....	.....	.....	.....	.....	23.25	.....	.....	.....	.....	....	IP
Bristol Aeroplane Co., Ltd. Filton House, Bristol	Proteus 2	AFP	12[11]	3	.....	.....	.....	.....	3200	10,000	3510	10,000	1025	9500	35,000	....	.084	272	.69	45	.....	.....	.....	113.35	38.5	3050	....	BTH, R	Elec.	....	X
	Coupled Proteus	AFP	12[11]	3	.....	.....	.....	.....	6400	10,000	7020	10,000	2050	9500	35,000	....	.088	544	.69	90	.....	.....	.....	167.3	80.4[7]	8106	....	BTH, R	Elec.	....	X
	Theseus 502	AFP	8[11]	3	.....	.....	.....	.....	2220	8200	2500	8200	1170	7800	20,000	145	.064	125	.773[9]	30	4.35:1	.....	.....	82.6	54	2205	....	BTH, R	Elec.	350	....
de Havilland Engine Co., Ltd. Stonegrove, Edgeware, Middlesex	Ghost 50	CFJ	1	1	5000	10,250	4300	9750	....	.....	....	.....	.....	.....	.....	.....	.....	735	1.08	87	4.67	*775*	720	70	53	2170	2208	Rotax	Elec.	250	IP
	Goblin 35	CFJ	1	1	3500	10,750	2950	10,250	.....	.....	.....	.....	.....	.....	.....	.....	.....	525	1.19	63	3.6	*800*	690	57	49.9	1610	1654	Rotax	Elec.	....	IP
Rolls-Royce Ltd. Derby	Avon R.A. 3[12]	AFJ		1	*7500**	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	*125*	*41.5*	*2450*	....	.....	.....	....	IP
	Derwent 5 & 8	CFJ	1	1	3600	14,700	3090	14,100	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.05	64.5	4.5:1	860	680	83.1	43	1280[13]	....	.....	.....	....	IP
	Dart 504	CFP	2	2	.....	.....	.....	.....	1400	14,500	.....	.....	1120	13,800	SL	365	.106	*145**	.83	.....	.....	.....	540	95.2	38.5	929	1024	.....	.....	....	IP
	Nene 3	CFJ	1	1	5100	12,500	4090	11,800	.....	.....	.....	.....	.....	.....	.....	.....	.....	....	1.06	89.5	4.8:1	870	400	96.8	49.5	1621[13]	....	.....	.....	....	IP
FRANCE																															
Societe Nationale d'Etude et de Construction de Moteur d'Aviation 150 Boulevard Haussmann Paris 13	ATAR 101B	AFJ	7	1	4840	8050	2070	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	....	1.1	.....	4.2:1	750	580	111.96	34.8	1870	....	ATAR, R	P, Elec.	.....	....
	TB 1000	AFP	9	2	.....	.....	.....	.....	1055	14,000	1450	15,400	.....	.....	.....	190	.....	....	.66	.....	.....	.....	.....	108	27	1080	1430	.....	.....	.....	.....
Societe de Construction et d'Equipments Mechaniques pour l'Aviation 60 Rue de Loudres Paris 8e	TGAI bis	AFP	15	4	.....	.....	.....	.....	1600	6350	3000	6350	.....	.....	.....	.....	5.77	....	.....	.....	.....	*600*	*400*	120	36[14]	.....	4360	.....	.....	.....	.....
	TGAR 1008	AFJ	8	1	4650	6600	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.03	.....	3.8:1[15]	*800*	*640*	110	36[14]	.....	2750	.....	.....	.....	.....
	TR 1008	AFJ	8	1	5290	6600	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3.8:1	*830*	*670*	84	39	.....	2320	.....	.....	.....	.....
Turbomeca Bordes	Pimene	CFJ	1	1	220	.....	180	.....	....	.....	....	.....	.....	.....	.....	.....	.....	....	1.05	.....	.....	.....	.....	31.5	15.75	.....	120	.....	.....	.....	.....

Italics: Aviation Week estimates.
* Approximate.
AFJ — Axial flow turbojet.
AFP — Axial flow turboprop.
CFJ — Centrifugal flow turbojet.
CFP — Centrifugal flow turboprop.
Elec. — Electric.

Eshp. — Equivalent shaft horsepower.
IP — In production.
P — ATAR 2-stroke 25-hp. gas engine.
R — Rotax.
SC — Special category.
X — Experimental.

[1] Includes starter, pumps, etc.
[2] Turbojet version of Mamba.
[3] Standard ratios: .0845:1; .1138:1; .0972:1.
[4] Five-minute limit.
[5] Or Rotax electric.
[6] Lb./hr./eshp.
[7] Maximum width.
[8] Or BTH or Rotax turbo.
[9] With tailpipe.
[10] Expendable turbojet for missiles.
[11] Plus 1 centrifugal stage.
[12] The experimental R.A.2 Avon's official rating is 6000 lb. thrust.
[13] Includes starter.

Foreign Military and Civil Aircraft

Manufacturer and Address	Designation		Category	No. of crew; passengers	Powerplant			Performance							Weights				Dimensions				Remarks
					Number, make and model of engines	Normal rated hp., lb. thrust or shaft hp.	At altitude (ft.)	Normal fuel capacity (gal.)[1]	Top speed (mph.)	Cruising speed (mph.)	Initial rate of climb (fpm.)	No wind, SL takeoff over 50 ft. obstacle (ft.)	No wind, SL landing over 50 ft. obstacle (ft.)	Normal range (mi.)	Gross weight (lb.)	Empty weight (lb.)	Wing loading (lb./sq. ft.)	Power loading (lb./hp., lb./lb. thrust, lb./ehp.)	Span	Length	Height	Wing area (sq. ft.)	
AUSTRALIA																							
Commonwealth Aircraft Corp., Pty. Ltd. Fishermans Bend, Pt. Melbourne	CA14 CA22	Mustang 20	Fighter Trainer	1 3	1 R-R Merlin V-1650-4 1 P&W Wasp Jr.	1180 400	11,300 5500	153 65	434 145	265 120	1800 1400	2400 1260	1395 900	800 400	10,500 3660	4200	45 14.6	8.8 9.1	34′ 38′ 9″	32′ 2″ 28′ 10.5″	13′ 3″ 8′ 3″	233 250	NAAF-51 development. 2 prototypes.
CANADA																							
Canadair Ltd. Montreal, P. Q.	C-4 F-86E	Canadair 4 Sabre	Transport	4:40	4 R-R Merlin 626	1500	7750	3220	329	265	990	3800	4950	2400*	82,000	48,883	56.3	11.65	117′ 6″	93.6′	27′ 6″	1457	Also built for RCAF. NAA F-86E (see U. S. Military table).
Cancargo Aircraft Mfg. Co., Ltd. 621 Craig St., W Montreal 3, P. Q.	CAM-1	Loadmaster	Transport	2	2 P&W 2SD13G	1200	5300	790	230	196	1280	1680	1900	1440	28,500	18,000	23.1	11.9	80′	54′ 6″	.....	721	Burnelli development.
de Havilland Aircraft of Canada Ltd. Postal Station L Toronto, Ontario	DHC-1 DHC-2[2]	Chipmunk Beaver	Trainer Transport	2 1–2:5–6	1 DH Gipsy 1-G 1 P&W R-985-AN-6B	145[3] 450[3]	SL SL	36 114	140 171	134 137	900 1290	870 880	930 1516	485 630	1930 4820	1184 2810	11.2 19.2	13.8 10.7	34′ 4″ 48′	25′ 5″ 30′ 3″	7′ 10′ 7″	172.5 250	Price $12,405. Price $26,450.
Found Bros. Aviation Ltd. Malton Airport, Toronto, Ont.	FBA-2	.....	Personal	4	1 DH Gipsy Major 1-C[4]	130*	.....	38	.....	.....	.....	.....	.....	.....	2200	1225	.....	.....	36′	24′ 8″	9′	.....	Prototype only.
A. V. Roe Canada Ltd. Box 430 Postal Terminal Toronto, Ont.	CF-100 C-102[5]	Canuck Jetliner	AW Fighter Transport	2 3:50	2 R-R *Avon R.A. 3* 4 R-R Derwent 501	*7500** 3600	*SL* SL	 2300	 500	 430	 2000	 3900	 2760	..... 1000[6]	 65,000	 35,000	 55	....	..... 98′ 1″	..... 82′ 9″	..... 26′ 5.5″	 1157	Also to use Avro Orenda jets. First prototype.
ENGLAND																							
Airspeed Ltd. Christchurch, Hampshire	AS-57	Ambassador	Transport	3:47	2 Br Centaurus 661	2270	6000	1000	312	280	1500	3270	2700	900	52,000	35,884	43.3	10	115′	81′	18′	1200	Basic price $420,000.
Sir Armstrong Whitworth Aircraft Ltd. Baginton, Coventry	AW 55	Apollo Meteor N.F.11	Transport AW Fighter	4:26–31 2	4 AS Mamba 2 R-R Derwent 5	1320[7] 3600	SL SL	974	....	*808*	1500	3300	4200	*1382*[8]	45,000	28,750	....	....	92′ 43′	71′ 11.5″ 48′ 6″	26′ 13′11″	986 374	Payload 7500 lb. In production.
Auster Aircraft Ltd. Rearsby Aerodrome Rearsby, Leicester	J.1 J.1B J.5B	Autocrat Aiglet Autocar Auster T.7	Personal Personal Personal Trainer	2 2 3 2	1 Bl Cirrus Minor 2 1 DH Gipsy Major 1 1 DH Gipsy Major 1 1 DH Gipsy Major 7	100 130 130 145	....	15 15 32 23	113 121 117 *98*	96 103 100 *80.8*	410 710 525 680	1515 1140 1845 1110	1086 1290 1476 1392	300 240 490 290	1850 2000 2400 2190	1052 1215 1413 1530	10 10.8 13 11.9	10.5 15.4 18.5 15.1	36′ 36′ 36′ 36′	23′ 5″ 23′ 8″ 23′ 4″ 23′ 2″	8′ 1″ 8′ 9″ 8′ 10″ 8′ 8″	184.5 184.5 184.5 184.5	Service ceiling 10,300 ft. Service ceiling 15,000 ft. Service ceiling 11,000 ft. Service ceiling 12,000 ft.
Blackburn & General Aircraft Ltd. Brough, E. Yorkshire	G.A.L.60 Y.A.5 Y.B.1 B.37	Universal Freighter .... Firebrand T.F.5	Transport ASW ASW Fighter	4:90 3 3 1	4 Br Hercules 730 1 R-R Griffon 1 AS Double Mamba 1 Br Centaurus 9	1670 ..... 2640[9] 2225	6000 ..... SL 13,000	3000 239	239 341	180 255	700 2500	3360 580	2760	1615 740	107,500 16,317	62,636 11,878	36 .... 42.8	13.5 .... 6.53	162′ 44′ 51′ 51′	99′ 42′ 42′ 34′	33′ 16′ 16′ 15′	2916 .... 381.5	Cargo capacity 34,535 lb. DH props. Rotol props. Rotol 168-in. prop.
Boulton Paul Aircraft Ltd. Wolverhampton	Balliol P.111	T.2	Trainer Research	2 1	1 R-R Merlin 35 1 R-R Nene	1055 5000*	9250 SL	125	289	267	1790	1350	1950	*731*	8450	7462	33.8	6.6	39.33′ 33′ 6″	35.125′ 26.1′	9′ 6″ 12′ 6″	250 *287*	DH 135-in. prop. Delta wing.
Bristol Aeroplane Co., Ltd. Filton House, Bristol	164 167 170 175	Brigand Brabazon 2 Freighter 30	Fight.-Bomb. Transport Transport Transport	3 6:100 3:44 7:50–92	2 Br Centaurus 57 4 Br Coupled Proteus 2 Br Hercules 734 4 Br Proteus	2810[10] 3400[11] 1650 3560[14]	SL SL 5000 SL	1058 15,180 1170 5790	358 355 230	311 330 166 330	1500 1400 1100	..... 4575 2500	..... 3900 3100	..... 5500[12] *1405*[12] 2700	39,000 300,000 42,000 130,000	25,598 170,000 28,900[13] 72,000	54.3 55.4 28.2 63.3*	7.85 11 10.5 9.13*	72′ 4″ 230′ 108′ 140′	46′ 5″ 178′ 10″ 68′ 4″ 114′	17′ 6″ 49′ 7″ 21′ 6″ 36′ 8″	718 5422 1487 2055	Rotol 168-in. props. Rotol 192-in. props. Rotolor DH 168-in.props. Rotol 192-in. props.
Chrislea Aircraft Co., Ltd. Exeter Airport, Devon	C.H.3	Skyjeep 4	Personal	4	1 Bl Cirrus Major 3	145	SL	37	126	113	550	1050	750	510	2550	1580	14.4	16.5	36′	22′ 2.5″	7′	177	Standard model $6295.

(Footnotes on p. 170)

Down but not out! U.S. Navy jet fighter pilot (inset) is dazed as he floats in the icy waters off Korea after crash landing near the carrier LEYTE. Moments later, the carrier's Sikorsky helicopter plucked him from the sea and deposited him on the carrier's flight deck—damp and shaken, but otherwise unhurt. Sikorsky has pioneered in air-sea rescue work since 1947, and developed the technique of using power hoists to bring "ditched" pilots aboard. Today, more efficient than destroyers as plane guards, Sikorsky helicopters are based on all the flattops of the fleet. Destroyers are thereby released for other duties. Through January 15, more than fifty Navy carrier pilots had been rescued by these "life guards of the air."

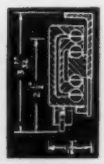
This is another of many military uses being found for these rugged Sikorsky helicopters. The versatile performance of this dependable craft points to an even greater military potential, as well as countless civilian uses.

SIKORSKY AIRCRAFT

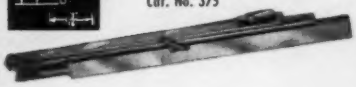
BRIDGEPORT, CONNECTICUT

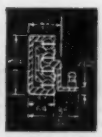
ONE OF THE FOUR DIVISIONS OF UNITED AIRCRAFT CORPORATION

Sliding Devices Save Time in Ground and Air Installations!

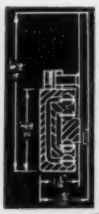


Three section slide, progressive action type. Locks in extended position only. Tripping mechanism controls unlocking. Load capacity: Up to 200 lbs.
Cat. No. 375



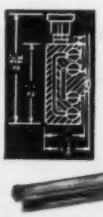


Three section slide, progressive action type. Load Capacity: Up to 50 lbs. per pair.
Cat. No. 350



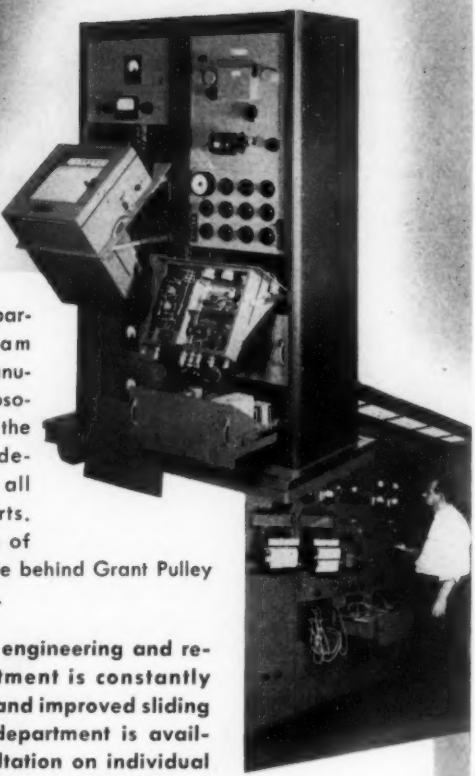
Three section slide, progressive action type. Locks in open and closed positions. Provided with quadrant to allow for tilting to 90 degrees. Load Capacity: Up to 200 lbs.
Cat. No. 364

Three section slide, progressive action type. Locks in open position. Slide includes mechanism for unlocking from the outside of chassis and for tilting to 90 degrees. Load Capacity; up to 100 lbs. per pr.
Cat. No. 392



Three section slide, progressive action type. Locks in extended position only. Thumb release controls unlocking. Load Capacity: Up to 200 lbs. maximum.
Cat. No. 371

Illustrations show an Automatic Transmission Measuring Set as developed by Bell Telephone Laboratories at Murray Hill, New Jersey. The receiving amplifier, modulator, amplifier modulator and recorder panels are suspended on *ball-bearing* drawer slides and are pivoted to permit the chassis to be inverted for servicing. The arrangement is such that all these panels can be kept in operation while an inverted.



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GRANT PULLEY & HARDWARE CO.

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31-91 WHITESTONE PARKWAY · FLUSHING 9-1900

Manufacturer and Address	Designation		Category	No. of crew: passengers	Powerplant			Performance							Weights				Dimensions				Remarks
					Number, make and model of engines	Normal rated hp., lb. thrust or shaft hp.	At altitude (ft.)	Normal fuel capacity (gal.)[14]	Top speed (mph.)	Cruising speed (mph.)	Initial rate of climb (fpm.)	No wind, SL takeoff over 50 ft. obstacle (ft.)	No wind, SL landing over 50 ft. obstacle (ft.)	Normal range (mi.)	Gross weight (lb.)	Empty weight (lb.)	Wing loading (lb./sq. ft.)	Power loading(lb./hp., lb./lb. thrust, lb./shp.)	Span	Length	Height	Wing area (sq. ft.)	
de Havilland Aircraft Co., Ltd. Hatfield, Hertfordshire	DH100	Vampire 5	Fighter	1	1 DH Goblin 2	3100	SL	330	531	497	4250	2625	3300	1090	10,520	7253	40.1	3.4	38′	30′ 9″	6′ 2″	262	Service ceiling 40,000 ft.
	.....	Vampire 30[15]	Fighter	1	1 R-R Nene2VH	4500	SL	330	542	420	.....	2030	.....	600	12,400	6419	49.4	2.48	40′	30′ 9″	6′ 2″	250.4	Auxiliary fuel 200 gal.
	DH104	Dove	Transport	2:8–11	2 DH Gipsy Queen 70-4	330	5000	130	210	179	850	2370	2250	450	8500	5530	25.3	12.3	57′	39′ 4″	13′ 4″	335	$49,000* basic price.
	DH106	Comet	Transport	4:36–48	4 DH Ghost 50	4300	.....	6050	.....	490	.....	6525*[16]	.....	3540[17]	105,000	.....	52	5.25	115′	93′ 1″	29′ 4″	2015	$1,260,000* basic price.
	DH112	Venom 2	AW Fighter	2	1 DH Ghost	4300	SL	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	38′ 4″	36′ 7″	.....	279	Vampire development.
	DH114	Heron	Transport	2:14–17	4 DH Gipsy Queen 30-2	215	3000	183	.....	160	1200	1980	1350	460	12,500	7960	25.6	12.5	71′ 6″	45′ 6″	14′ 2″	499	$98,000* basic price.
	DH115	Vampire Trainer	Trainer	2	1 DH Goblin 3	3350	SL	330	550	520	4500	2685	3495	950	11,030	.....	42.1	3.29	38′	34′ 6″	9′ 2″	262	Airspeed Ltd. will produce.
English Electric Co., Ltd. Queens House, Kingsway, London, W. C. 2	.....	Canberra 2	Bomber	3	2 R-R Avon R.A.3	*7600**	*SL*	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	64′	65′ 6″	15′ 7″	.....	High-altitude type.
Fairey Aviation Co., Ltd. Hayes, Middlesex	.....	Firefly 5	Fighter	2	1 R-R Griffon 74	2250	9300	291	386	203	5000[18]	.....	.....	790	13,927	.....	41.6	6.89	41.2′	38′	16′ 6″	330	Carrier based.
	17	.....	ASW	2–3	1 AS Double Mamba	2950[19]	SL	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	54.3′	43′	13′ 9″	.....	Rotol props.
Gloster Aircraft Co., Ltd. Hucclecote, Glos	.....	Meteor 7	Trainer	2	2 R-R Derwent 5	3500	SL	325	585	535	7920	2350	2800	820	14,000	10,290	40	.....	37′ 2″	43′ 6″	13′	350	Service ceiling 46,000 ft.
	.....	Meteor 8	Fighter	1	2 R-R Derwent	3500	SL	380[20]	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	37′ 2″	44′ 7″	13′ 10″	350	In production.
	.....	Meteor 9	Fight.-Reconn.	1	2 R-R Derwent	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	37′ 2″	44′ 7″	13′ 10″	350	In production.
	.....	Meteor 10	Photo	1	2 R-R Derwent	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	43′ 10″	44′ 3″	13′	374	In production.
	.....	Meteor P.V.	Attack	1	2 R-R Derwent	.....	.....	580[20]	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	37′ 2″	44′ 7″	13′ 10″	350	Private venture.
Handley Page Ltd. Cricklewood, London, N.W. 2	H.P.67	Hastings 2	Transport	5:50	4 Br Hercules 106 or 736	1475	8000	3172	349	316	885	5325	4290	1671	80,000	48,427	56.8	11.9	113′	81′ 8″	22′ 6″	1408	Troop transport.
	H.P.81	Hermes 4	Transport	5:74	4 Br Hercules 763	1675	5750	3026	310	291	975	4080	3570	1837	86,000	55,350	61.1	10.2	113′	98′ 10″	30′	1408	Cargo capacity 19,300 lb.
	H.P.82	Hermes 5	Transport	5:74	4 Br Theseus	2490	SL	3532	355	355	1690	3300	2790	2025	90,000	49,228	63.8	7.98	113′	96′ 10″	30′	1408	Cargo capacity 17,000 lb.
	H.P.R.1	Marathon 1	Transport	2:18	4 DH Gipsy Queen 70	308	7750	280	232	209	683	3090	3630	500	18,000	11,616	36.14	13.04	65′	52′	14′	498	Basic price $120,400.
	H.P.R.1	Marathon 2	Transport	2:18	4 AS Mamba 2	800	SL	414	290	255	1550	2550	1860	980	18,000	10,212	36.14	7.94	65′	52′ 2″	14′ 1″	498	One-engine climb 600 fpm.
	H.P.R.2	.....	Trainer	2	1 AS Cheetah 18	385	3500	62	173	155	1100	1350	1200	422	4400	3354	19.73	10.48	37′	30′	9′ 9″	222	DH or Rotol 114-in. prop.
Hawker Aircraft Ltd. Canbury Park Road Kingston-on-Thames	.....	Sea Hawk	Fighter	1	1 R-R Nene 4	5000[22]	SL	.....	*600**	.....	.....	.....	.....	.....	.....	.....	.....	.....	39′	40′	10′ 6″	278	Bifurcated jet pipe.
	P.1081	.....	Fighter	1	1 R-R Nene 4	5000[22]	SL	.....	*650+*	*600+*	.....	.....	.....	.....	.....	.....	.....	.....	31′ 6″	37′ 4″	.....	258	Sweptwing.
Percival Aircraft Ltd. Luton, Bedfordshire	.....	Prentice 3	Trainer	2	1 DH Gipsy Queen 70	295	8000	40	165	151	765	1020	1550	445	4200	3500	13.8	12.35	46′	31′ 3″	11′ 6″	305	DH 90-in. prop.
	P.50	Prince 3	Transport	2:8–12	2 Al Leonides 502/4	450	7500	173	232	190	1110	2280	1950	894	11,000	7611	30.2	9.8	56′	42′ 10″	16′ 1″	365	Basic price $78,400.
	P.56	.....	Trainer	2	1 AS Cheetah 18	385	3500	50	177	153	1100	1260	.....	.....	4050	3300	18.95	9.65	35.16′	27.3′	10′ 9″	214	Rotol 108-in. prop.
A. V. Roe & Co., Ltd. Greengrate, Middleton, Manchester	.....	Lincoln 30[23]	Bomber	7	4 R-R Merlin 85B	1400	9000	2850	300	200	800	5580	3180	2800	82,000	44,000	57.7	14.6	120′	78′ 4″	20′ 3″	1421	DH 156-in. props.
	696	Shackleton G.R. 1	Patrol	10	4 R-R Griffon	2450[21]	SL	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	120′	77′ 6″	17′ 6″	1421	DH props.
	701	Athena 2	Trainer	2	1 R-R Merlin 35	1250[22]	SL	140	300	230	2100	1875	2070	575	8500	6500	31.4	6.75	40	37′ 6″	12′ 10″	270	Service ceiling 30,000 ft.
	706	Ashton 1	Research	5	4 R-R Nene	5000[23]	SL	3100	.....	.....	.....	.....	.....	.....	82,000	.....	.....	.....	120′	89′ 6″	30′ 9″	1421	High-altitude research.
	707B	.....	Research	1	1 R-R Derwent	3500[23]	SL	.....	.....	.....	.....	.....	.....	.....	*7000**	.....	.....	.....	33′	41′ 10.5″	12′ 5.5″	*363**	Aerodynamic research
Saunders-Roe Ltd. Osborne, E. Cowes, Isle of Wight	SR/A1	.....	Fighter	1	2 M-V Beryl	3850[23]	SL	415	*600+*	.....	.....	.....	.....	.....	16,250	.....	39	2.1	46′	50′	17′	415	Flying boat.
	SR/45	.....	Transport	15:105	10 Br Proteus	3500[23]	SL	14,500	.....	380	.....	.....	.....	5500[13]	315,000	.....	63	9	219′ 6″	148′	55′ 9″	5000	DH 198-in. props.
Scottish Aviation Ltd. Prestwick Airport, Scotland	.....	Pioneer 2	Personal	5	1 Al Leonides 501/4	440	8750	60	162	120	1148	690	680	427	5400	3909	13.2	10.4	52.79′	34.58′	10.08′	410	DH or Rotol 108-in. prop.
Short Bros. & Harland Ltd. Queens Island, Belfast	S.A.2	Sturgeon 2	Target Tow	2	2 R-R Merlin 140	1180	10,800	407	366	312	2280	1650	2500	1190	22,350	17,647	34	6.5	50′ 9″	49′	13′ 3″	653.5	Rotol 120-in. props.
	S.B.3	.....	ASW	.....	2 AS Mamba	1320[22]	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Modified Sturgeon.
	S.A.6	Sealand 1	Transport	1:5–8	2 DH Gipsy Queen 70-3	295	8000	119	190	172	750	2160	2460	500	9100	7065	25.8	13.4	50′	42.58′	14.08′	353	DH 90-in. props.
Vickers-Armstrongs Ltd. (Weybridge Works), Weybridge	.....	Valetta 1	Transport	4:36	2 Br Hercules 230	840	10,000	724	294	260	1300	3750	4275	1500	36,500	25,545	41.4	9.24	89′ 3″	65′ 2″	19′ 6″	882	Rotol 168-in. props.
	.....	Valetta 3	Trainer	4:10	2 Br Hercules 230	840	10,000	724	294	260	1300	3750	4275	1500	36,500*	25,545*	41.4*	9.24*	89′ 3″	65′ 2″	19′ 6″	882	RAF crew trainer.
	V.C.2	Varsity	Trainer	11	2 Br Hercules 264	830	10,000	750	290	240	1500	3420	3390	1600	37,500	27,000	38.5	9.61	95′ 8″	67′ 6″	23′ 11″	974	RAF crew trainer.
	700	Viscount	Transport	3-5: 40-48	4 R-R Dart R.Da. 3	1400[23]	SL	1720	370	340	1750	3660	2100	1000	52,500	32,000	54.5	9.4	94′	81′ 2″	26′ 9″	963	Cargo capacity 6440 lb.
(Supermarine Works) Hursley Park, Hants	.....	Attacker	Fighter	1	1 R-R Nene 3	5000[23]	SL	293	585	540	6250	2340	2790	590	7798	.....	52	.....	30′ 11″	37′ 6″	9′ 6.5″	226.4	Carrier fighter in production
	535	Swift	Fighter	1	1 R-R Nene 3	5000[23]	SL	400	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	31′ 8.5″	42′ 11″	12′ 6″	295	Auxiliary fuel 250 gal.
Westland Aircraft Ltd. Yeovil, Somerset	.....	Wyvern 2	Fighter	1	1 AS Python	3670[23]	SL	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	44′	42′	.....	.....	Carrier based.

(Footnotes on p. 170)

Italics: Av Wk estimate.
* Approximate.
Al: Alvis.
All: Allison.
AS: Armstrong Siddeley.
AW: All-weather.
ASW: Anti-sub. warfare.
Bl: Blackburn.
Br: Bristol.
DH: DeHavilland.
GR: Gnome-Rhone.
His: Hispano-Suiza.
HS: Hamilton Std.
Ly: Lycoming.
M-V: Metro.-Vick.
P&W: Pratt & Whitney.
Ren: Renault.
R-R: Rolls-Royce.
SL: Sea level.
[1] Imp. gal. (1.2 U.S. gal.)
[2] Takeoff power.
[3] USAF version is C-127A.
[4] Or 1 Bl Major 3 @ 155 bhp.
[5] First prototype.
[6] Max. 2200 mi. still air.
[7] + 405 lb. jet thrust.
[8] At 25,000 ft.
[9] + 810 jet thrust.
[10] With meth.-water inj.
[11] + 800 jet thrust.
[12] Max. range.
[13] 32 passengers.
[14] Equiv. bhp. each.
[15] Built by DH Austr.
[16] Condition not given.
[17] Max. range.
[18] In 2 min. 55 sec.
[19] Equiv. shp. each.
[20] Aux. fuel only.
[21] Takeoff power.
[22] Built by Austr. govt.
[23] Or 4 AS double Mambs.
[24] Max. range 2983 mi.
[25] + His Nene in tail.
[26] Max. range.
[27] Swedish built.
[28] Or Ly O-435-A.

Manufacturer and Address	Designation		Category	No. of crew: passengers	Powerplant: Number, make and model of engines	Powerplant: Normal rated hp., lb. thrust or shaft hp.	Powerplant: At altitude (ft.)	Performance: Normal fuel capacity (gal.)	Performance: Top speed (mph.)	Performance: Cruising speed (mph.)	Performance: Initial rate of climb (fpm.)	Performance: No wind, SL takeoff over 50 ft. obstacle (ft.)	Performance: No wind, SL landing over 50 ft. obstacle (ft.)	Performance: Normal range (mi.)	Weights: Gross weight (lb.)	Weights: Empty weight (lb.)	Weights: Wing loading (lb./sq. ft.)	Weights: Power loading (lb./hp., lb./lb. thrust, lb./shp.)	Dimensions: Span	Dimensions: Length	Dimensions: Height	Dimensions: Wing area (sq. ft.)	Remarks
FRANCE																						
S.A. des Ateliers d'Aviation Louis Breguet 24 Rue Georges Bizet Paris 16	97	Fulgur	Transport	100	4 All T-38[25]	2750	SL	.....	.....	400	.....	.....	.....	.....	107,800	.....	.....	.....	.....	.....	.....	.....	Project.
	763	.....	Transport	4+:120	4 P&W R-2800CA18	1800	6000	3366	248	224	.....	3650	3350	2367[26]	105,600	52,536	53	11.0	140' 10"	94' 11"	31' 4"	1996	HS 145.5-in. props.
	890H	Mercure	Transport	2	2 Br Hercules 739	1565	.....	705	236	186	.....	1800	1200	621	39,600	22,330	36.3	9.75	110' 5"	70' 10"	23' 7"	1090	20 on order.
	891R	.....	Transport	5	2 SNECMA 14R-200	1282	.....	1250	261	186	836	2545	2595	1242	37,148	25,353	.....	.....	100' 4"	71'	23' 7"	1087	Military version of 890H.
	892S	Mercure	Transport	3:40	4 Ren 12S02-201	390	8530	705	218	177	.....	2630	1970	621	35,200	19,778	32.4	14.9	100' 5"	70' 10"	23' 7"	1090	Ratier props.
	960	.....	TorpedoBomb.	2	1 AS Mamba 1[27]	.....	.....	.....	580	.....	.....	.....	.....	.....	19,600	14,960	.....	.....	54'	40' 2"	13' 5"	387	2 built.
Boisavia Moiselles	B 60	Mercure	Personal	4	1 Ren 4PE1	140[2]	.....	.....	150	120	.....	405	240	600	2140	1180	11.8	15.3	33' 9"	21' 3"	6' 3"	193.5	15 built in 1950.
Avions Marcel Dassault 46 Ave. Kleber Paris 16	MD 315	.....	Transport	2:6	2 Ren 12S 02-201	495	7200	220	.....	180	.....	1800	2300	745	13,200	.....	.....	.....	68'	41'	15'	510	Dassault 108-in. prop.
	MD 450	Ouragan	Fighter	1	1 His-Nene	4600	SL	250	600	535	7800	2100	2350	.....	12,320	7250	.....	.....	40'	35'	13' 1"	256.9	MD452 similar.
Avions Hurel-Dubois 12 Rue Chappe Paris 18	HD 10	.....	Research	1	1 Mathis G2F	32	SL	12	135	115	400	2000	1000	800	1150	770	25	29	40'	18'	4.2'	46	Aspect ratio is 32.5.
Ets Foupa & Cie Aire-S L'Adour Landes	CM8R9.8	Cyclope 1	Glider	1	1 Turbomeca Pimene	256	.....	.....	200	.....	.....	.....	.....	200	1110	780	.....	3.47	26' 1"	19' 8"	.....	105.5	Jet power auxiliary.
	CM8R13	Sylphe	Glider	1	1 Turbomeca Pimene	176[2]	.....	26.5	162	150	790	1500	....	185	1182	805.4	8.44	6.72	42'7.75"	21' 10"	5' 10"	140	Jet power auxiliary.
	CM100	.....	Transport	2:18	2 Ren 12S 02-201	495	1640	260	160	158	.....	.....	....	900[28]	15,600	11,600	.....	.....	88'	59'	19'	770	Ratier 99-in. props.
Avions Rene Leduc 39 Ave. de Castres Toulouse	O.10	.....	Research	2	1 Leduc ramjet	3500	SL	220	.....	530	12,000	.....	.....	.....	6200	.....	.....	.....	34' 6"	33' 7"	.....	172.4	Air launched from carrier plane.
Matra Boulogne	R 1	Rey	Personal		2 Ren GQ10	.....	.....	.....	210	.....	.....	.....	.....	.....	5030	4300	.....	.....	41' 7"	27' 6"	10' 8"	.....	Articulated wings.
Aeroplanes Morane-Saulnier 3 Rue Volta Puteaux Seine	MS-472	.....	Trainer	2	1 GR 14M	650[2]	SL	108	293	260	1600	.....	....	950	5240	4320	27	7.7	34' 11"	28'	10'	186	500-plane backlog.
	MS-700	.....	Colonial	4	2 Potez 4D33	160[2]	SL	.....	180	161	945	1310	900[9]	745	4885	3620	17.89	15.18	46' 7"	32' 6"	11' 2"	265.1	MS-702 seats 6.
Societe D'Etude et de Constructions Aero-Navales 40 Rue H. Barbusse Gennevilliers	SUC-10	.....	Personal	4	1 Mathis 8G40	190	.....	55	130.4	118	.....	1750	....	650	3430	2233	16	17	40' 6"	26' 10"	8' 9.5"	205.5	Twin-boom pusher.
Societe Industrielle pour l'Aeronautique Place Eugene Sue Suresnes	S11	.....	Trainer	2	1 Ren 12S 00	390	8530	53	223	205	1772	.....	....	435	4563	3699	23.13	7.6	36' 1"	30' 7.25"	8'	196.9	100 in service.
	S901	.....	Personal	2	1 Minie 4 DC-32	70	SL	13	125	110	455	970	1250	320	1320	795	10.5	16.9	27'	18'	5.2'	124	Service ceiling 12,200 ft.
Societe Nationale de Constructions Aeronautiques du Centre 12 Ave, Bosquet. Paris	NC211	Cormoran	Transport	4:131	4 GR 14R	1200	.....	.....	249	199	.....	3400	....	1243	92,593	52,910	43	14.65	144' 4"	100'	33' 1.5"	2152	Cargo capacity 5297 cu. ft.
	NC853	.....	Personal	2	1 Minie 4DC-32	70	SL	12	95	87	460	380	650	310	1408	801	8.04	18.15	36' 11"	22' 5"	.....	166.2	100 on order.
	NC1071	.....	Torpedo	3	2 His-Nene	4600	SL	665	492	476	4725	1010	....	.....	25,190	16,258	46.94	.....	65' 7"	34' 6"	14' 9"	538	Service ceiling 43,230 ft.[8]

Societe Nationale de Constructions Aeronautiques du Nord 20 Rue Vernier Paris 17	N1203	Noreorin 2	Personal	4	1 SNECMA Regnier 4LO	136	SL	26.5	174	136	980	800	550	590	1440	1340	16.3	16	34'	24'	9'	140	264 in production.
	N1400		Patrol		2 SNECMA 14R	1220			225	220				1900	41,500				104'			929	Amphibian.
	N2200		Fighter	1	1 His-Nene	4600	SL	470	570	550	4500	2700		550	17,650	10,650			39'	44'	11.8'	290	Service ceiling 38,000 ft.
	N2500		Transport	5	2 SNECMA 14R	1200	2800	440	255	220				950	40,000	35,500			106'	66'	19'	929	Cargo capacity 1690 cu. ft.
Societe Nationale de Constructions du Sud-Est 6 Ave. Marceau Paris 8	SE161		Transport	6-33	4 GR 14N 65/69	1020		1350	299	233	591			1678	45,364	27,890	37.86	44.47	96' 5"	79' 7"	16' 10"	1198	160 built.
	SE1010		Photo		4 SNECMA 14R 29/29	1325	3200	3500	323	249				3110	72,160	39,000			101.86"	71.54'	21'	1252	2 built.
	SE2010		Transport	6-34	4 P&W R-4360B13	2650	6000	6938	335	276		3980	3750	3600	165,000	81,633			160' 7"	129' 11"	44' 3.5"	2536	Cargo capacity 1700 cu. ft.
	SE4000		Executive	4-6	1 Mathis G16	450*	SL	145	155	150				620	6100	4300			54'	37'	13'	334	1 flying.
Societe Nationale de Constructions du Sud-Ouest 105 Ave. R. Poincare Paris 16	SO30P		Transport	4-36	2 P&W R-2800CA18	1800	6000	840	304	273		4080	3280	853	42,182	27,350			85'	65' 1.5"	19'	928.7	Nene-powered version planned.
	SO95		Transport	2-10-16	2 Rm 12S 02-201	390	8530	248	221	218		1900	2070	750	12,346	9018			59'	49' 5"	14' 1"	405	Cargo capacity 460 cu. ft.
	SO342		Research	1	1 R-R Derwent 5	3000	SL	144							10,340	8450			29'	32' 5.5"		193.7	Flying model for SO4000.
	SO4000		Bomber	2	2 His-Nene	4600	SL	1430	580	515		2000			60,000	32,000			58'	64' 9"		807	Bomb load 5 tons.
	SO6000		Trainer	2	2 His-Nene	4600	SL	320	630	594	9940	1370		600	10,032	7050			32'	34' 2"		161.4	Prototype flying.
	SO6020	Espadon	Fighter	1	1 His-Nene	4600	SL	495	700	647	5500	2790			17,640	11,287			34'	45' 2"		271	3 flying; 8 building.
	SO7060	Deauville	Personal	3	1 Walter Minor 4-111	80		13	127	106		550		400	1760	1140	10.8	16.7	34'	21' 11"	7' 11"	161.4	2 prototypes flying.
	SO8000	Narval	Fighter	1	1 Arsenal 12H 02	1740	21,000	265	453					2900	15,430				39' 6.5"	38' 8.5"		285	Prototype flying.
SWEDEN Svenska Aeroplan A.B. Linkoping	Saab-21R	J-21R	Fighter	1	1 DH Goblin 3**	3300*	SL		590*										37.3'	33.24'	9.31'	240	Twin-boom, twin tail.
	Saab-29	J-29	Fighter	1	1 DH Ghost**	5000*	SL		651+										36.09'	33.29'	12.8'	258	Variable incidence tail.
	Saab-90A-3	Scandia	Transport	3-5-32	2 P&W R-2180E1	1400	6200	770	280	242	1350	2700	1870	1654	35,273	21,958	38	9.8	91.10'	69.11'	23.3'	922	HS 146.75-in. prope.
	Saab-91A	Safir	Personal	3	1 DH Gipsy Major 10**	145*	SL	28.5	164	146	935	1115	805	555	2195	1278	15	15.66	34' 9"	25' 7"	7' 8"	146.3	Stalling speed 53 mph.

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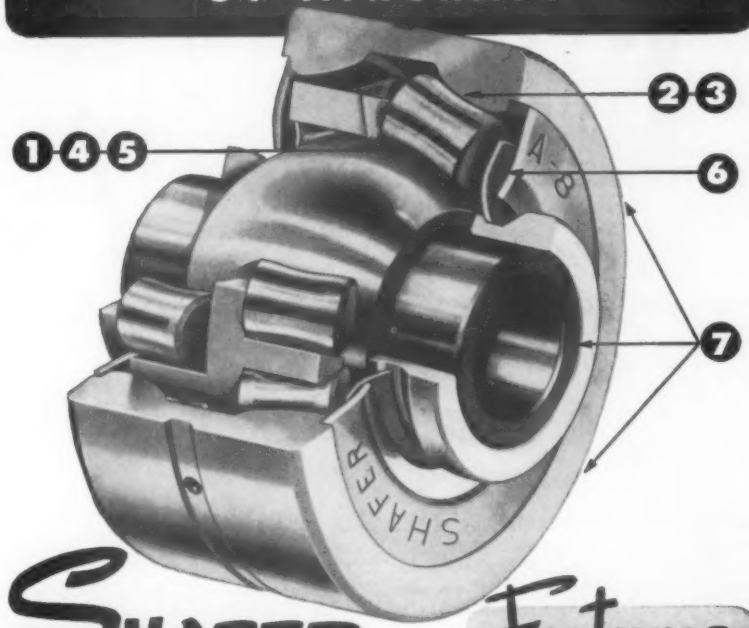

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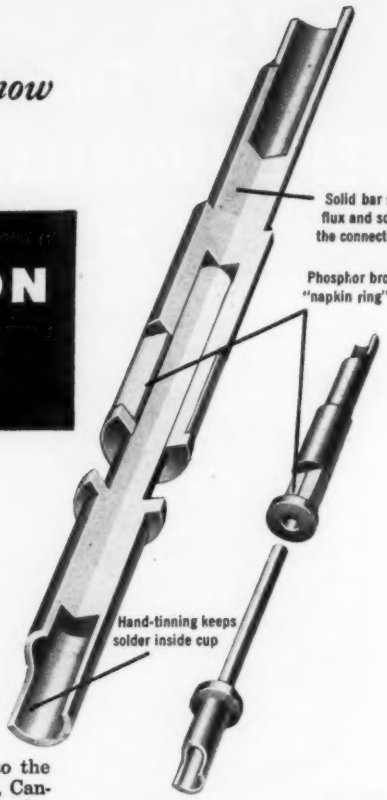
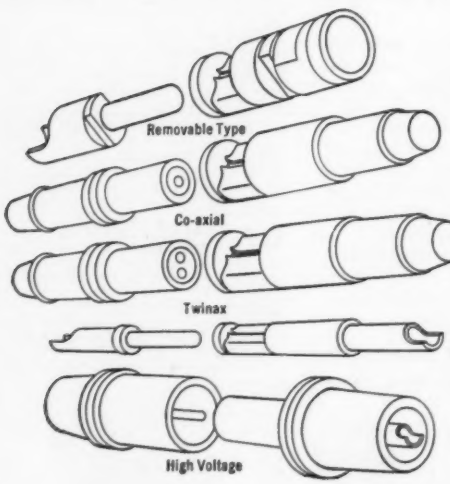
Here's why those in the know demand–

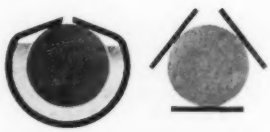
CANNON PLUGS

superior contact design


Solid bar stock keeps flux and solder out of the connector.
Phosphor bronze "napkin ring"
Hand-tinning keeps solder inside cup

Because the contact is the key to the success of any electric connector, Cannon has always applied the highest order of skill and care to this all-important detail. Cannon pin and socket contacts are all precision machined from solid bar stock. Silver or gold plating maintains high conductivity after years of constant use. Phosphor bronze "napkin ring" of the socket keeps pressure on large areas of heavy metal, preventing current loss. There are no thin metal tangent contact points in Cannon contacts. (See below). Solder cups are carefully tinned by hand to keep the solder inside the cup. Cannon socket contacts are full floating to assure perfect alignment. You'll find these design features throughout the great variety of precision contacts used in all Cannon connectors. For real value demand Cannon.





Cannon design (above left) makes contact on large, heavy metal surfaces. Current is not carried through spring section. In Cannon Connectors there are no thin metal tangent contact points, like the design shown at right.

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India

Transports, Fields Are Its Air Strength

(McGraw-Hill World News)

Bombay—India, with its highly strategic position in Asia could be an ideal air base for the United Nations. It has predominantly level terrain, consistently good flying conditions for nine months of each year and a huge territory to permit dispersal. Its many unused airfields are readily repairable, and its one aircraft factory in Bangalore could be quickly expanded.

But India has no present intention of affording aviation facilities or offering its air force to aid the western democracies in any future world war. Nor will it call on United Nations' military help until it is directly attacked.

The future of India's air force is severely limited by the economic strains of the country and depends indirectly on the pace of events in Asia. If these two factors should force India to realign its foreign policy with the West, it would as a corollary take more interest in its own air resources. But if India is ever to be a considerable air power, this will not be in the near future.

The Indian Air Force has ten squadrons (40 aircraft) of British-type fighters (Spitfires, Hurricanes, Vampires). These will be fully up to strength only by 1952. India has no bombers, and no plans to build up a bombing force.

▶**Transport Strength**—The two strongest features of its air resources are transports, of which it has about 200 (mostly Douglas 33-seaters employed in civil airlines), and airdromes, of which it has about 60 scattered over the country, many in the strategic northeast. Both of these are legacies from the British-American air effort in World War II, when China and Burma were supplied by air from Indian bases.

The speed and effectiveness with which India can mobilize its air transport was demonstrated in October 1947 when Kashmir was almost overrun by raiding tribesmen from Pakistan. Enlisting every available plane, the Indian government landed major units of the Indian army close to the Kashmir battlefield. The crisis was averted and the crucial valley of Kashmir remains in Indian hands today.

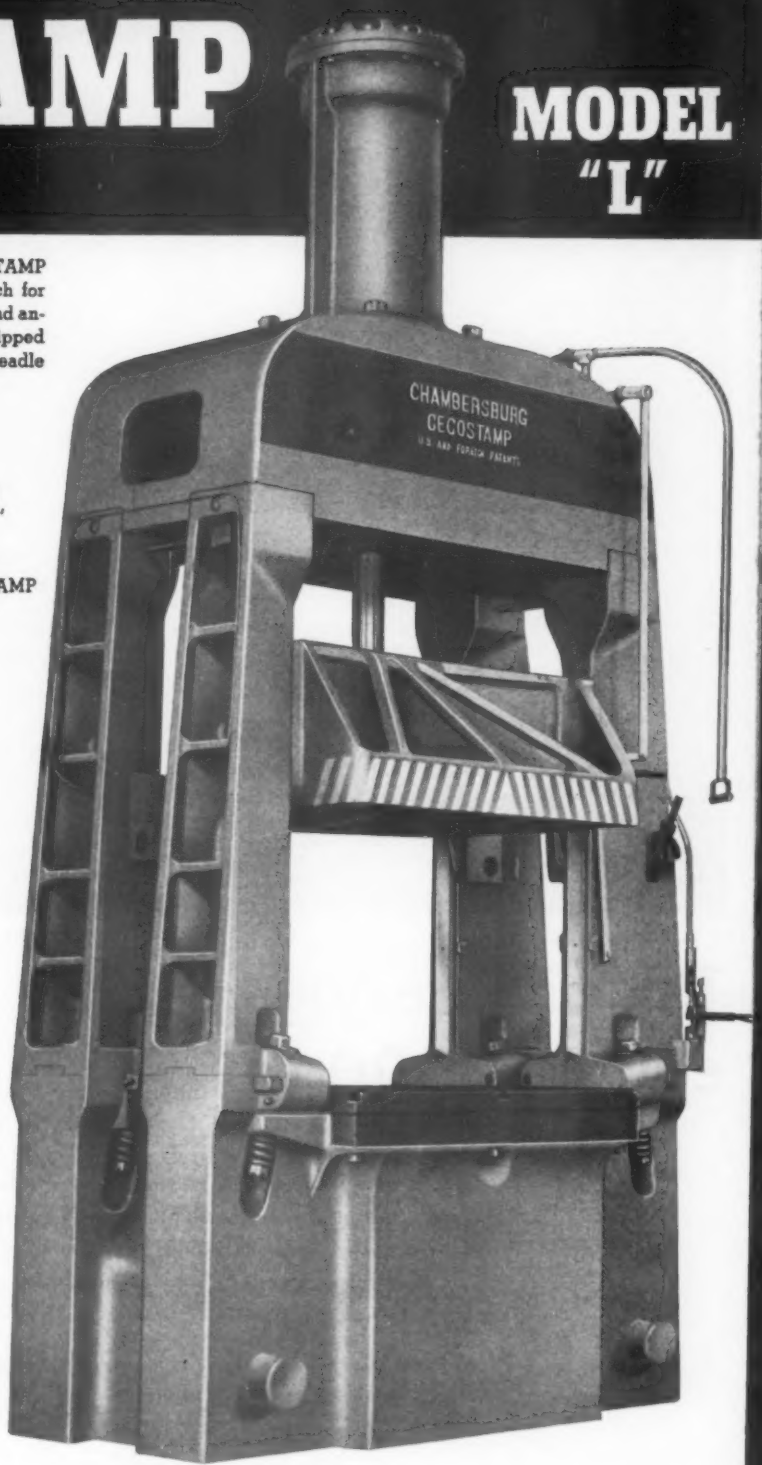
The government holds 210 million rupees' worth of aircraft and equipment bought on disposal from the U. S. government after World War II. The government of India wants to sell this material and either cannot afford or does not wish to put it into shape for its own use.

CECOSTAMP

MODEL "L"

30" x 24" CECOSTAMP showing special notch for keying dies in ram and anvil bolster plate. Equipped with special foot treadle

(At right) 66" x 60" Four-Column CECOSTAMP



Wider Range of Work: The Model "L" Cecostamp can handle a wider range of work than previous models.

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More Accurate Operation: Valve porting and valve rigging give smoother, surer ram action.

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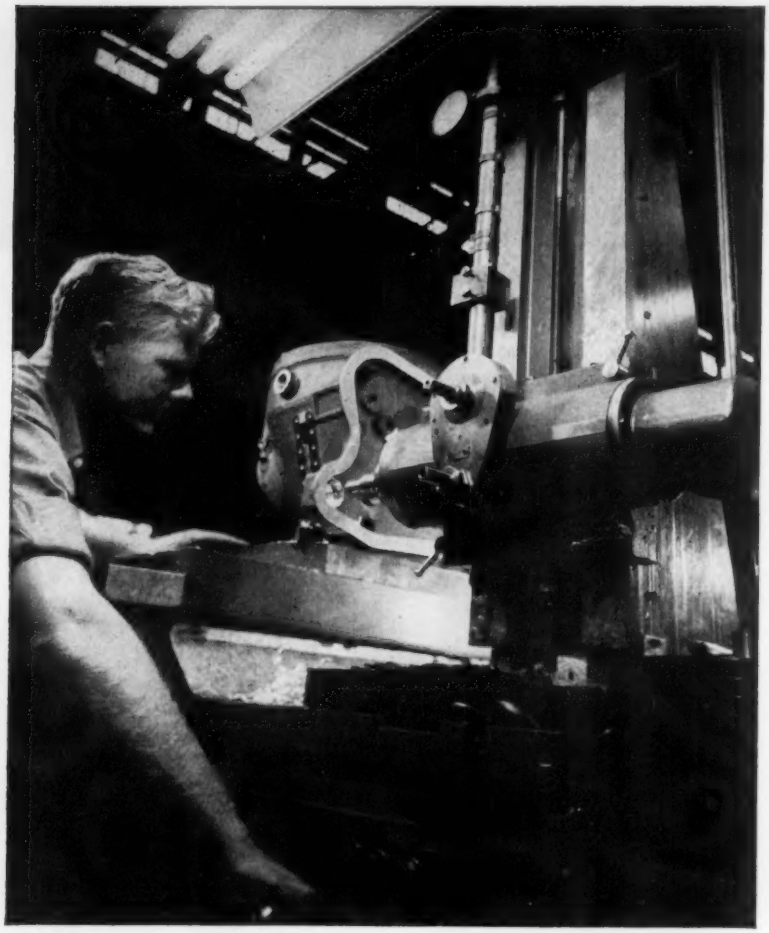

This picture* does not equal 10,000 words

This is a fine photograph—but men and machines are only part of the story at IGW. It takes esprit de corps (a much overworked term that fits here)—it takes pride of workmanship to produce fine precision gears and parts.

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Russia

Bombers Next

Lessons of past war learned, Soviet turns to long-range planes.

Russia's current concentration on jet interceptors is the tip-off on her desperate efforts to buy time to build strategic air power.

All recent evidence points to the tardy acceptance of the big-bomber theory by top planners of the Russian air arm. They have seen the effects of strategic bombing in Germany and they well realize their own weakness and U. S. strength in that field.

So, the disconnected bits of Russian aviation are being integrated into air power.

Historically, Red air strength has been geared to the close support of ground armies. But since the war, transition toward the conception of integrated air strength—and possibly an independent air force—has been underscored by these factors:

- **Interim jet fighters**—defensive weapons—were hastily built after the end of World War II.
- **Military and civil air transport** were strengthened immeasurably.
- **Advanced jet interceptors**, with samples now being service-tested in Korea, were developed with high priority.
- **Heavy bomber designs** are currently rumored. Russia's copy of Boeing's B-29—the Tu-4—can be classed as a medium bomber only.

Item by item, this list is not too impressive for any country with a large aircraft industry. But considered as an integrated pattern, the implication becomes clear. The realistic Reds realize the inherent strength of strategic air power. Hence, they plan first to develop defensive measures against it, and second to develop offensive methods using it.

▶ **Outside Help**—In piecing together available data on Russian aviation, it is apparent that there has been a sudden technical jump in the quality of their aircraft. At first glance, this discontinuity in the curve of progress seems to be tied to four factors:

- **German design projects** of every conceivable kind were accumulated at the beginning of the occupation.
- **Bulk of the German aircraft industry**, with technical laboratories and production tooling, came into Russian hands in the zoning of Germany.
- **German designers and technicians** of leading aircraft factories "emigrated" to Russia.
- **First-class British turbojets**, the Nene

and Derwent, were exported to the Russians.

Now this is not intended to underrate the Russian engineers and designers. A sample of their work is the M.38 aircraft reciprocating engine. They bought this engine from the Germans in 1930; it was then known as the BMW VI and developed all of 600 hp. The Germans stopped the development of the engines because they thought it had reached its technological peak. The Russian version today puts out 1800 hp.

Another sample of Russian technology, the MiG-15, can show its heels to best USAF fighters by its high rate of acceleration (probably accounted for by afterburning on its Nene-type engine). And its ability to climb at altitude (4000 fpm. at 30,000 ft.) has enabled many a Red pilot to live to fight another day. And its top speed of well over 600 knots is only 15 to 20 knots below that of the F-86 Sabre.

▶ **Changes in Time**—One of the most important clues in evaluation of military strength is the chronology of development or of transition. Here then is the best place to consider briefly the postwar history of the Red air fleets.

Russian air intelligence officers, roaming through defeated Germany, must

(*Continued on p. 178*)

beyond the BLACKOUT

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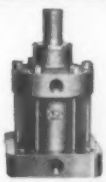

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USSR Military Aircraft

Class	Designation	Crew	Powerplant		Physical Data					Performance	
			No. and make of engines	Normal rated hp. or thrust	Span (ft.)	Length (ft.)	Weight (lb.)	Cargo or bomb load	Armament	Maximum Speed (mph.)	Maximum range (mi.)
Fighter (piston-engined)	MiG-3	1	1 AM35	1200	34.5	26.8	6200	.....	6 rockets	373	746
	La-3	1	1 M105P	1100	31.8	29.5	7050	.....	1x20mm cannon 1x12.7mm m/g 2x7.9mm m/g 6 rockets	345	398
	La-5	1	1 M82FNU	1650	32.2	27.8	8500	440 lb. bombs	2x20mm cannon	367	398
	La-9	1	1 ASH82FNU	1650	34.6	27.6	.....	.....	.....	400	746
	La-11	1	1 ASH82FNU	1650	31.3	27.7	.....	.....	.....	420	....
	Yak-9	1	1 M107	1800	32.8	28.0	6050	.....	1x20mm cannon 1x37mm cannon 2x12.7mm m/g rocket racks	368	650
Fighter (turbojet)	MiG-9	1	2 BMW003	1760[1]	42.0	38.0	.....	.....	2x23mm cannon	529	....
	MiG-11	1	1 BMW003	1760[1]	40.5	38.0	.....	.....	.....	592	....
	La-15[2]	1	2 Chelomey	....	40.0	35.0	.....	.....	.....	560	....
	La-17	1	1 Nene[3]	5000[4]	....	....	.....	.....	4 cannon	683	....
	Yak-15	1	1 M004	2225[5]	33.0	30.0	.....	.....	1x20mm cannon 2x12.7mm m/g	560	....
	Yak-17	1	1 Derwent[3]	3500[4]	....	....	.....	.....	4 cannon	600	....
	Yak-25	1	1 Nene[3]	5000[4]	....	....	.....	.....	4x20mm cannon	715	....
	MiG-15	1	1 Nene[3]	5000[4]	32.5	32.8	12,500	.....	4 cannon	747	....
Fighter (rocket-powered)	Yak-21[5]	1	2 109-509B rockets	3300	30.5	....	10,000	.....	.....	...	....
Attack (piston-engined)	Il-2	2	1 M38	1300	47.8	38.0	.....	8 frag. bombs	2x20mm cannon 2x7.6mm m/g	278	....
	Il-3	2	1 AM38	1300	49.1	38.5	.....	8 frag. bombs	2x23mm cannon 2x7.6mm m/g	270	....
	Il-10	2	1 AM42	2000	....	....	.....	.....	2x23mm cannon 2x7.6mm m/g	298	....
	Pe-2	3	2 M105R	1050	56.1	41.3	17,000	.....	3x7.6mm m/g	323	621
	Pe-3	3	2 M105R	1050	56.1	41.3	18,700	.....	3x7.6mm m/g 2x12.7mm m/g	335	932
Bomber (piston-engined)	Tu-2	4	2 ASH82FNU	1850	69.8	45.3	28,400	3750 lb. bombs	2x20mm cannon 3x12.7mm m/g	347	871
	Yer-2	4	2 M105R	1050	65.8	51.0	.....	.....	.....	261	....
	Yer-4	4	2 M103	1100	69.0	51.0	.....	8800 lb. bombs	2x12.7mm m/g	292	....
	Il-4	4	2 M82	1600	70.2	47.5	33,000	1 torpedo 6000 lb. bombs	2x7.6mm m/g	228	1000
	Ar-2	3	2 M105	1050	67.0	41.0	.....	3300 lb. bombs	3x7.9mm m/g	295	621
	Tu-4[6]	...	.....	....	141.0	....	....	.....	.....	...	....
	Pe-8	8	4 M82FNU	1650	131.3	80.5	49,000	8000 lb. bombs	1x20mm cannon 6x7.6mm m/g	296	2500
Bomber (turbojet)	Tu-8	5	2M004	....	....	....	.....	5000 lb. bombs	2x20mm cannon 3x7.6mm m/g	454	....
	Tu-10	4	2 M004R	....	70.0	60.0	.....	.....	.....	497	2000
	Il-16	4	4 M004	....	87.0	70.0	80,000	.....	.....	466	....
Transport	Il-12	4/3	2 ASH82FN	1810	104.0	70.0	38,600	32 passengers	.....	254	780
	Il-18	...	4 ASH82	1825	147.0	100.0	.....	66 passengers	.....	230	....
	Li-2	...	2 M63	1000	95.0	64.5	26,000	.....	.....	219	1620
	Tu-70[7]	5	4 M90	2030	141.0	118.0	.....	72 passengers	.....	320	2730
	ShchE-2	2	.....	150	....	....	.....	6 passengers	.....	137	400
	TB-3	...	4 M17	600	129.0	80.0	.....	.....	.....	112	....
Trainer (piston-engined)	La-7	2	1 M82	1650	....	....	.....	.....	.....	317	....
	Yak-7	2	1 M105	1100	32.8	27.8	.....	.....	.....	327	....
	UT-2	2	1 M11	110	33.5	23.4	.....	.....	.....	75	....
	Yak-18	2	1 M11	160	34.5	26.2	2430	.....	.....	158	547
Liaison, Hospital	Po-2	2	1 M11	110	37.5	26.7	1890	.....	.....	93	250
	Utka	2/3	1 M11	110	32.0	....	.....	.....	.....	...	....
Seaplane	KOR-1	2	1 M25	750	32.8	21.3	.....	.....	.....	156	....
	ARK-3	...	2 M25	635	79.0	57.5	11,700	.....	2 m/g turrets	200	....
	MBR-2	...	1 M34	850	59.0	41.0	.....	.....	2x7.6mm m/g	156	870
	MDR-6	...	2 radial	....	64.0	49.5	.....	.....	2 m/g turrets	...	....
	GST[8]	...	2 radial	....	104.0	63.8	35,000	.....	.....	193	3100

[1] Rating of German production version.
[2] Developed from German Me-262.
[3] Or Russian-built equivalent.
[4] Rating of British versions sold to Russia.
[5] Developed from Me-163B-O series.
[6] Russian-built B-29 copy.
[7] Tu-4 (B-29) except for modified fuselage.
[8] Modified Consolidated PBY.

NOTE: Russian aircraft and engines have been identified in two general ways: by function, and by designers. The former system was used from 1925 to 1940, and some planes (for example the UT-2 trainer, which designation comes from the Russian Uchebny Trenirovochny—Instructional and training) still retain the old designations.

Since 1940, the practice has been to use the first two or three letters of the name of the principal designer or design team. These designations appear in the table:

Aircraft—
- Il— Sergei Ilyushin
- La— Semyon Lavochkin
- MiG— Artem Mikoyan and Mikhail Gurevich
- Pe— Vladimir Petlyakov
- Po— Nikolai Polikarpov
- ShchE— S.Shcherbakov
- Tu— Andrei Tupolev
- Yak— Aleksandir Yakovlev

Engines—
- AM— A. A. Mikulin
- ASH— A. D. Shvetsov
- M— Motor (under old functional system)

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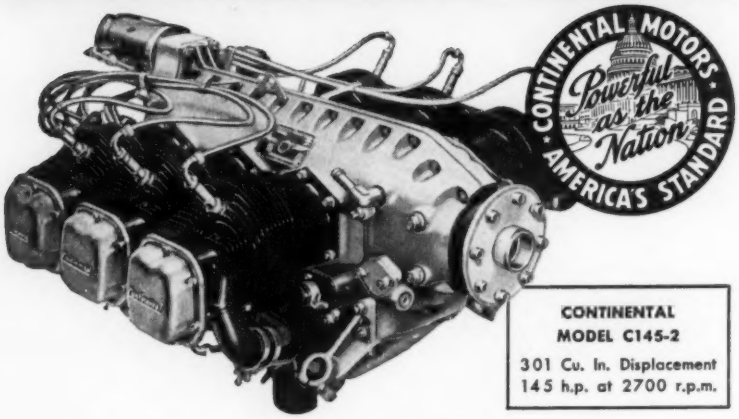

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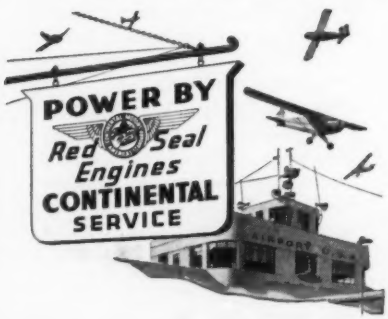

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Continental Motors Corporation
Aircraft Engine Division
MUSKEGON, MICHIGAN

have been awed completely by the devastation of mass bombing. They saw how German industry and transportation was completely knocked out by heavy bomber raids.

And like soldiers everywhere, they must have translated the wreckage back to the main streets of their home. Out of that shattering experience must have come the resolve that such a thing must never happen to Mother Russia; then, as a second thought, there must have come the realization that some day, they too must have a bomber force.

But first, there were more important jobs. The United States already had a bomber force, and so the Soviet strategy saw a counter-measure, the jet fighter, as the answer. In jet development, they had little background, no experience. But they were overrunning a country full of specialists in that field. Quietly and efficiently, the Reds rounded up designers from the German factories. In Russia, they were given free rein to develop projects they had under way at the end of the war.

Meantime, and whether or not with the aid of Germans is hard to tell, the Reds cobbled up two interim jet fighters, the Yak-15 and the MiG-9. They were combinations of tried and tested airframes and tried and tested engines. The only catch was that they had been tried and tested under different conditions; the Reds flew them under the same conditions. Apparently, Yak-15 was the more successful, because it became the mainstay of Russian interceptor squadrons and is still in service in satellite air forces.

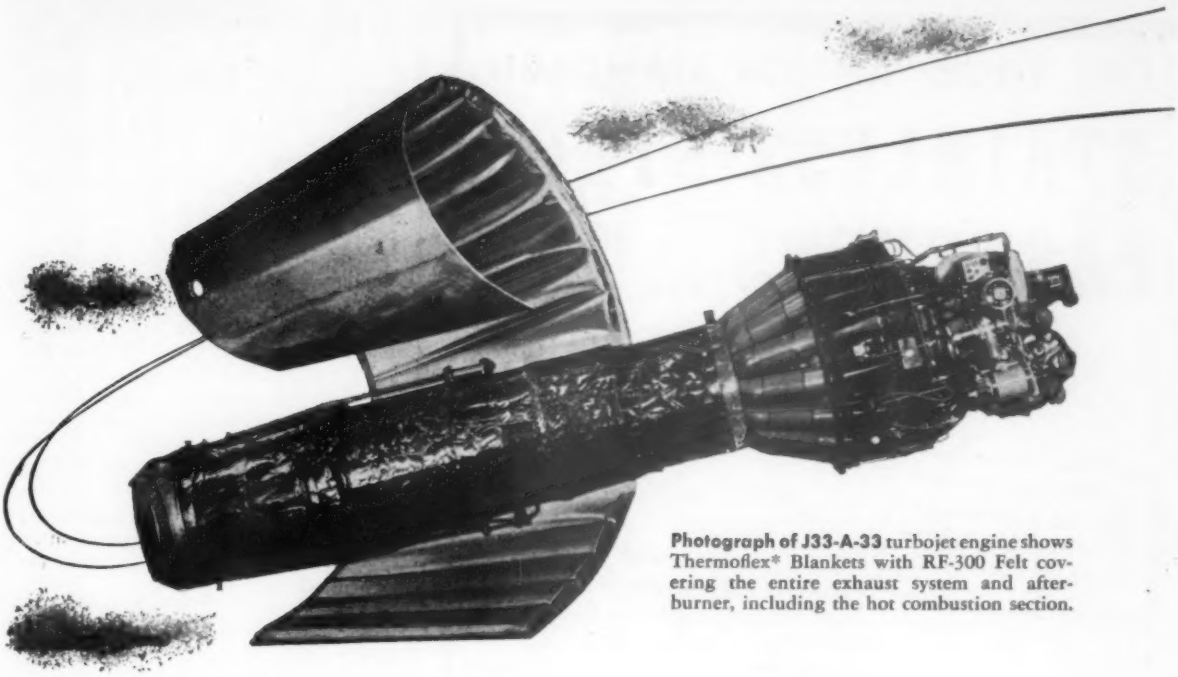
► **Transports Next**—But jet interceptors to stave off the enemy were not enough. Russia's antique rail and road could never withstand heavy bombing. Red answer had to be air transportation.

In quick succession, Russian designer Ilyushin developed the Il-12, counterpart of our Convair 240 or Martin 2-0-2, and the four-engined Il-18. Tupolev contributed a new fuselage to the B-29 and called it the Tu-70. (To our best knowledge, several hundred Il-12s have been built, and the recently shown captured movies featured dozens of these planes lined up on a runway waiting for takeoff.)

With transportation needs of the Army arranged, and with an interim jet fighter in service, the Russians were ready to undertake studies of advanced fighters.

After the transports, there was a short breathing spell. Then in rapid succession came reports of sweptwing fighters. First credited to Lavochkin, then to Yakovlev, then to Mikoyan and Gurevich, these beauties blasted trails of rumors across the entire continent of Europe.

► **Three Fighters**—With all the shout-



Photograph of J33-A-33 turbojet engine shows Thermoflex* Blankets with RF-300 Felt covering the entire exhaust system and afterburner, including the hot combustion section.

New type J-M *THERMOFLEX BLANKET*

insulates world's first production jet with afterburner

SHIELDING the entire afterburner and exhaust assembly on the Air Force's new J33-A-33 turbojet engine for the Lockheed F-94 All-Weather Fighter required an insulation that could withstand not only terrific temperatures, but high frequency vibration as well.

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Air Materiel Command flame tests show this new felt has excellent stability at 2000F. Its insulating efficiency is such that a ½" thick blanket produces a 1500° temperature drop between the hot face and the cold side of the screen when the hot face is in the range of 1900-2000F. And it so effectively dampens high-frequency vibration that thermocouple leads, as well as fuel, air, igniter and hydraulic lines can be mounted directly on the blanket, utilizing smaller, lighter clips than previously required.

Thermoflex Blankets are fabricated with the RF-300 Felt sealed between sheets of corrosion-resistant Inconel or stainless steel, edge-folded and seam- or spot-welded as required. They are custom-made for insulating entire powerplant assemblies such as aviation gas turbines and exhaust systems and to insulate, protect and fireproof heating systems, fluid storage tanks, air-conditioning systems, thermal de-icing ducts, etc. Special preformed shapes are also available to fit the intricate surfaces involved in many aircraft and powerplant applications.

For the full story on Thermoflex Blankets and RF-300 Felt, write for Brochure AV-1A. Address Johns-Manville, Box 290, New York 16, N. Y.

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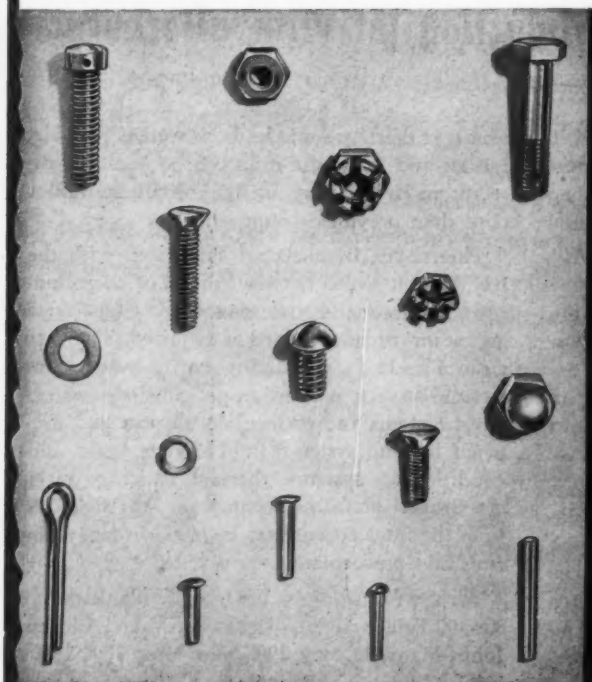

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ing over, it seems that there are, after all, three of these new interceptors. One is for each of the top Russian designers with the exception of Ilyushin—he's been busy on bombers and transports—and Tupolev—he designs ground-support craft.

These are the three airplanes which are in—you might call it—service competition. The MiG-15 is probably the furthest along of the lot, because it has appeared in squadron service on many fields in Germany. And in Korea, the yo-yo tactics of the MiG are being pitted against first the F-80 then the F-86 and now the F-84, plus the F9F. Combat reports of Red pilots will be carefully compared for estimates of performance of our top fighters.

Chances are that they know by now (after reading that the F-80 put up an inadequate performance against the B-36) whether or not their interceptors have a prayer of stopping the superbomber.

(Incidentally, in the rush to develop interceptors, the historical role of Red air strength in army cooperation has not been neglected. Ilyushin's Stormovik, or Iron Ivan as the Germans called it, has been superseded by the Il-10, faster and heavier-armed. The Tu-2 attack plane has a younger jet brother, the Tu-8, and a later twin-jet version, Tu-10, which has been compared to the Canberra or the B-45.)

▶ **Current Status**—This history has now arrived at the contemporary level. And sifting facts and weighing such evidence as is available suggest three broad conclusions:

• **Soviet air power** until recently has not been bomber-minded. This is borne out by their operations in WW II and by their past chief functions as ground-support for troops.

• **Russia has been restrained** from direct military action only by U. S. strategic air power. They have seen the effects of strategic bombing. They know and respect our possibilities as proven by their current concentration on defensive jet interceptors.

• **Russia's next major air advance** will be heavy bomber. This is certainly logical, and it is the one missing factor in making Russia a power to be feared in the air.

And this step is going to be the most difficult one for them to take. In the development of the intercontinental bomber, this country has nearly a ten-year lead. The Russians have little background and little experience in design and construction of really heavy aircraft. Neither do their German emigrees. Neither do the engineers in any of the satellite countries. And there is nothing they can import that will help, either.

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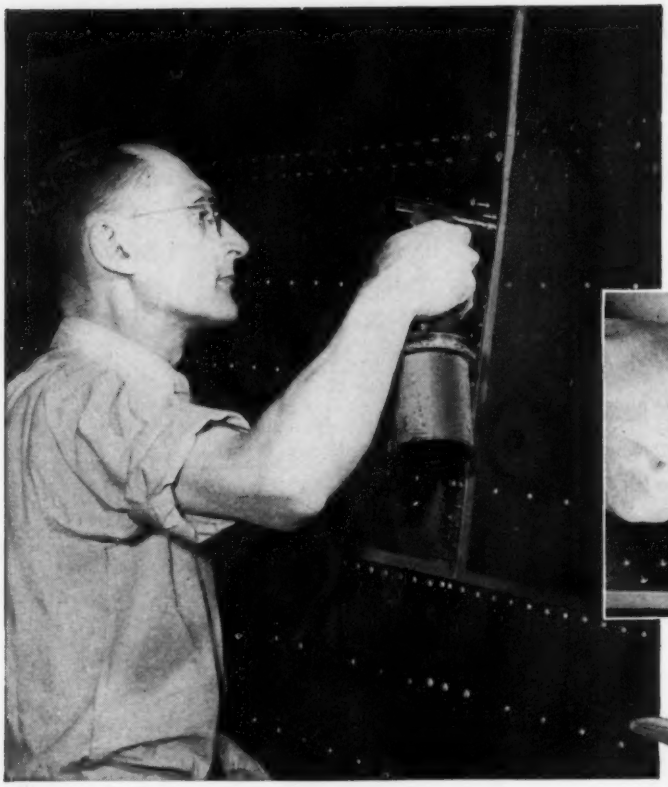

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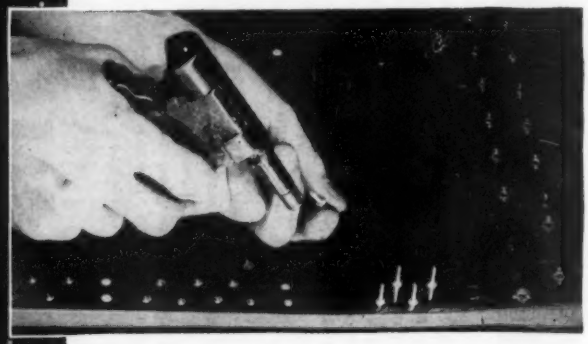

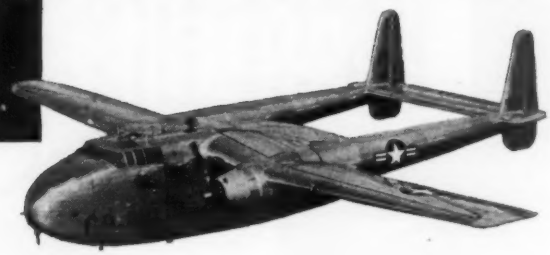

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Better Blimps Ready for Anti-Sub Role

Prototype is biggest yet; U. S. stockpile in good shape.

By Alexander McSurely

U. S. lighter-than-air power, thanks to a good-sized stockpile of its famous World War II Type K blimps, is in much better shape to start hunting submarines, its principal wartime mission, than it was at the beginning of World War II. And a fair-sized procurement program for new and modernized blimps is in the cards.

Goodyear Aircraft Corp., only U. S. builder of complete airships in recent years, is now completing the prototype of the biggest non-rigid yet, a formidable addition to the K-Type and M-Type blimps which comprise the present operational craft.

More than 130 of the K ships were built in World War II, and more than 5000 Navy pilots and crews were trained to operate lighter-than-aircraft. It is expected that a considerable number of them could be called back either as instructors for new crews or, after refreshers, to return to active duty themselves.

▶ **On the Record**—Navy's lighter-than-airmen are proud of their World War II record, with some reason. It is estimated that the blimps escorted approximately 90,000 surface craft without a single vessel lost to submarines while under escort. Only one blimp, the K-74, was lost in action with a German submarine.

With a sufficient store of fireproof helium gas in reserve to meet any contemplated expansion of the airship program, the U. S. is still well ahead of any other nation in this natural advantage.

There appears little chance, currently, that rigid airships will come back into the U. S. lighter-than-air picture, although Goodyear is still urging the advantages of building several huge 10-million cu. ft. volume rigid airships as cargo carriers and perhaps as aircraft carriers.

Prospects are that Navy's still relatively modest lighter-than-air procurement funds will continue to go for the non-rigids. It looks like the Navy may standardize on an improved version of the K ships (ZP4K) for coastal anti-submarine patrols and training and on its new N ships, supplemented by the slightly smaller M ships, for long-range ocean patrols. All will carry elaborate long-range radar search equipment.

Navy already has four of the M ships (725,000 cu. ft.), one of which set a world flight endurance record of 170 hr. Volume of current K-ship's envelopes is stepped up to 456,000 cu. ft. and on some of the newer ones to 527,000 cu. ft. But the four new N ships will be still larger. The prototype, due to fly this spring, has an 875,000 cu. ft. gas bag and later versions will increase this volume to just under a million cu. ft.

Few of the World War II training ships, the little Ls (which were con-

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Grumman's latest planes, still shrouded in security, will employ Aerotec controls.

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verted from peacetime sight-seeing vehicles) and the slightly larger Gs remain in commission, and they are used only for experimental projects.

Postwar developments in refueling airships while in flight from surface vessels were started about two years ago, and have progressed to a point where it is no longer necessary to push an airship to its extreme range without refueling.

Postwar techniques have also been perfected to rearm and to take on supplies from surface vessels while continuing flight, and to reballast in flight by taking on water from the ocean.

All the blimps now operational and those forthcoming are equipped or are being equipped with power winches for use in resupplying while in flight, and also for air rescue work.

▶ **The Job**—Primary job of these lighter-than-aircraft is to patrol and accompany convoys to spot enemy submarines. But the blimp itself doesn't act as the sub-killer unless emergency requires. And usually its very presence makes the sub keep its head down. Once the undersea prowler is spotted and marked with sonobuoys, the blimp calls for heavily armed sub-killer planes like the big Grumman AF-2s and Douglas AD series to finish off the sub with bombs.

(*Continued on* p. 188)

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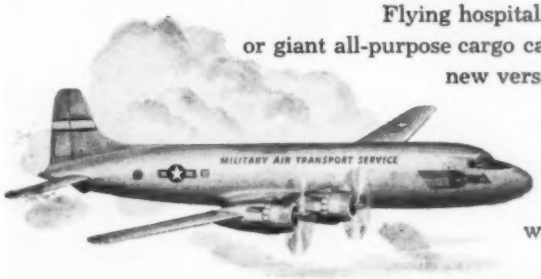

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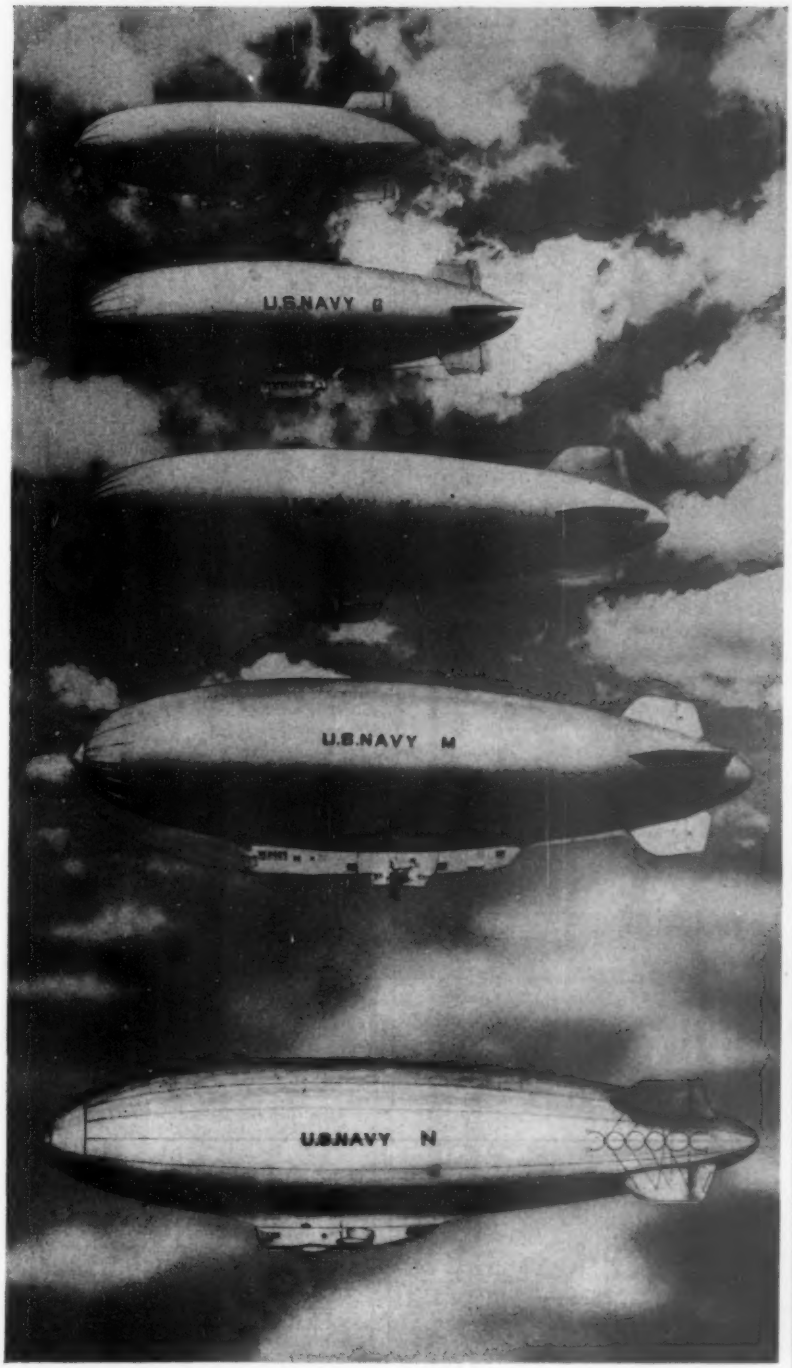

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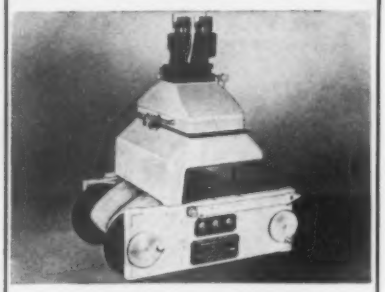
ZPL	123,000	147	46	60	12	0	19
ZPG	183,000	187	45	65	24	0	7



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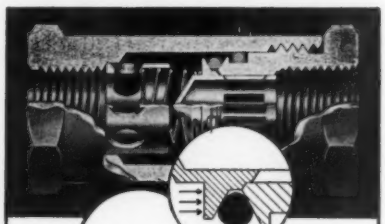
However with the new threat to U. S. cities from off-shore submarines which may launch missiles carrying atomic warheads, the network of anti-submarine defenses is required to be far more efficient than ever before.

Navy's first new N-ship, now virtually complete, is an interesting example of how far lighter-than-air non-rigid design has progressed from balloon days.

▶ **Up-to Date**—The prototype ship uses a new type envelope made of neoprene-coated Fortisan rayon, which is lighter than the cotton fabric envelopes customarily used. Navy researchers are not entirely satisfied with the new material in its present state, so pending further improvements they expect to use long-stapled cotton fabric envelopes on some of the production N ships. Due to the additional weight of the cotton envelopes a larger volume of lifting gas will be required, hence the increase to a



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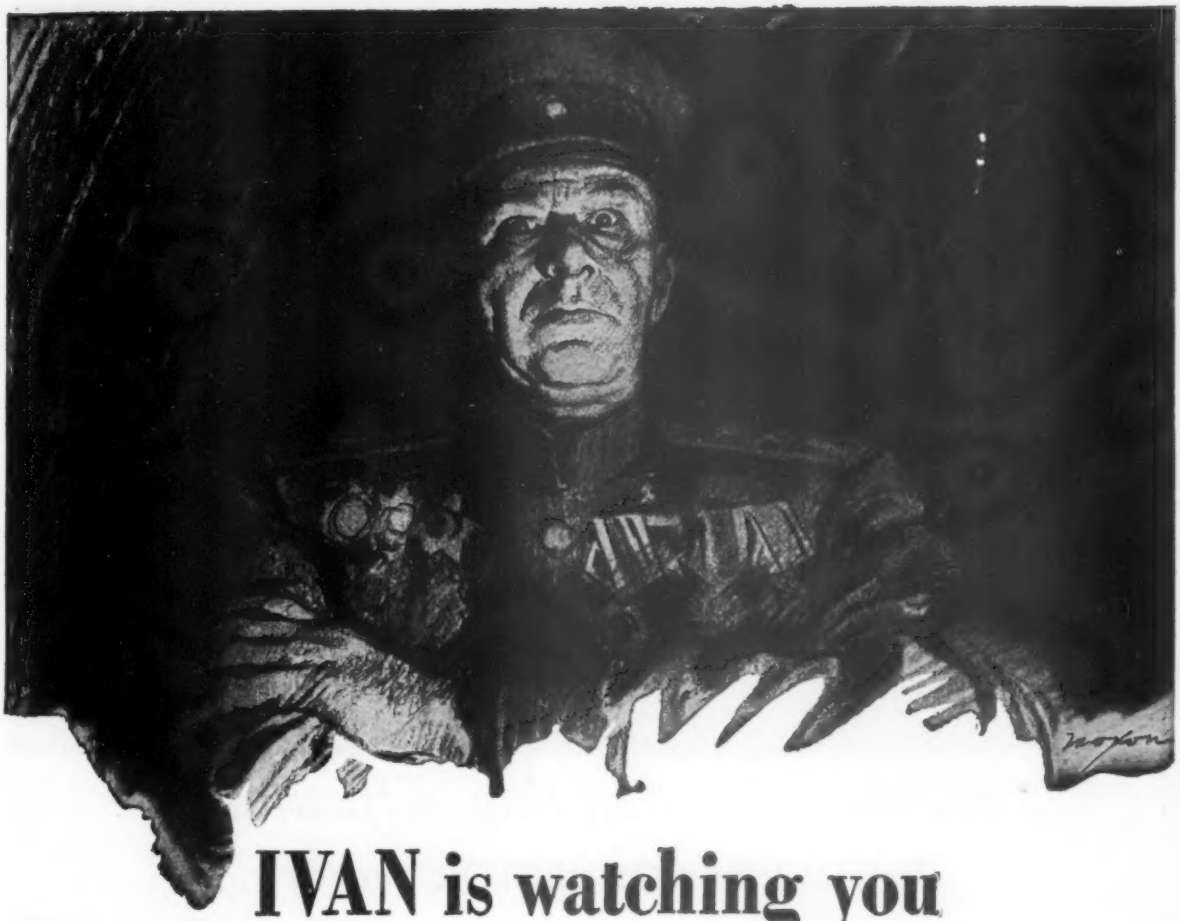

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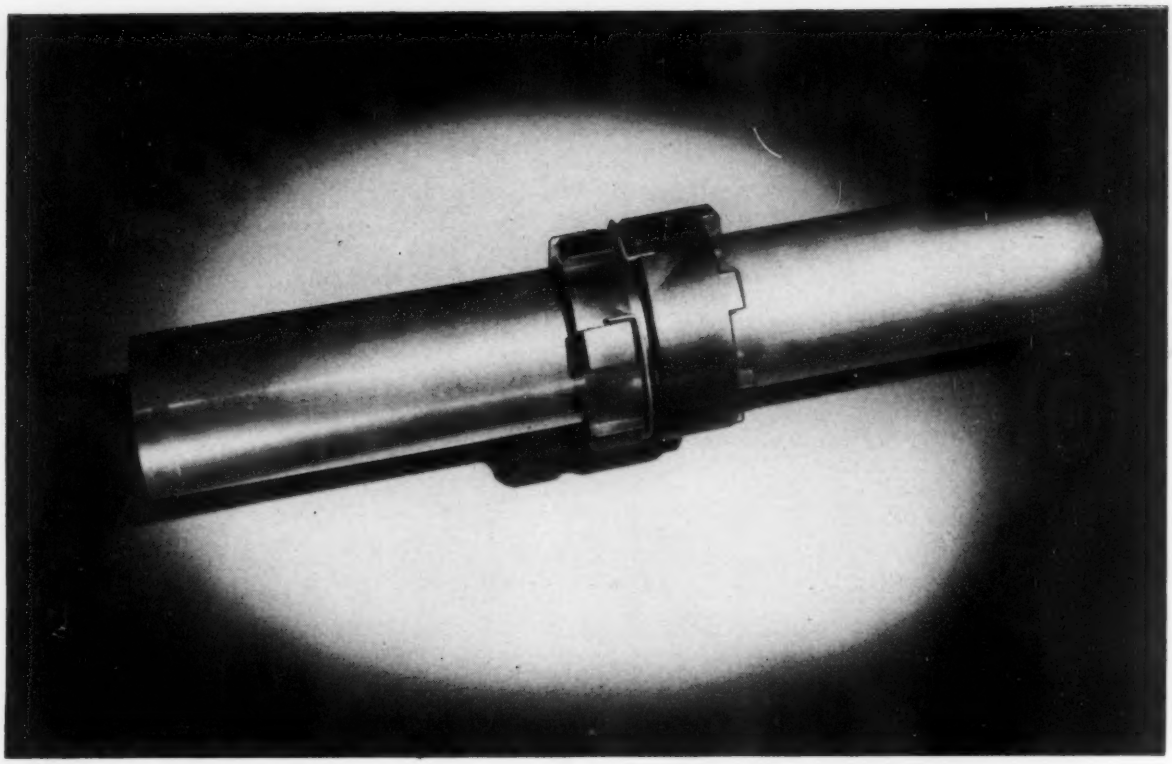

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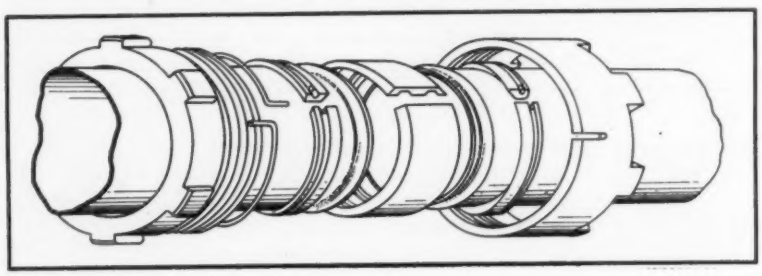

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The envelope of the prototype N ship is 324 ft. long and 71 ft. in diameter, while the two-deck car attached to it is 83 ft. long.

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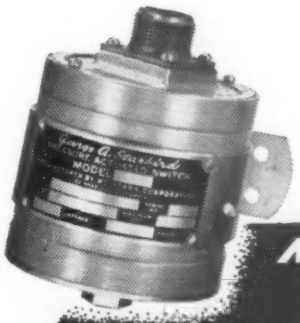

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SOUTH KOREA: UN wounded are loaded on a Bell H-13D helicopter near Mun-mang-ni for evacuation to a rear hospital. (Acme Photo)

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The helicopter has "come into its own" in Korea. Only the most glowing reports of achievements have been attributed to military helicopters and their crews. One of the most commendable "mercy mission" performances won the Distinguished Flying Cross for the U. S. Army's Second Helicopter Detachment on January 14, 1951.

The award was made in recognition of the successful evacuation of 23 wounded men from the battlefield to a hospital 25 miles in the rear. Using four Bell H-13D helicopters, U. S. Army pilots completed the assignment in 2½ hours. One helicopter suffered 18 bullet holes during its flights.

In addition to the Army's H-13D, Bell HTL-4s are also serving in Korea. One Marine helicopter pilot made the most of his HTL-4 by evacuating four wounded (two in the cockpit and one each in litters) on one trip.

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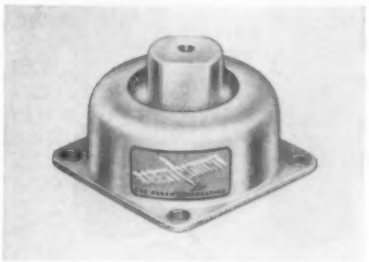

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- 502 – Air-damped Barrymounts for aircraft service; also mounting bases and instrument mountings.
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- 504 — Shock mounts and vibration isolators for marine, mobile, and industrial uses.
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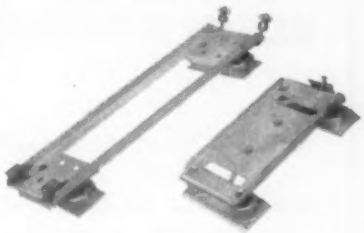

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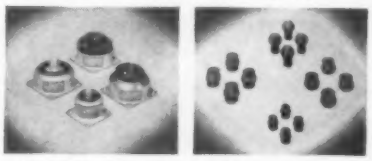

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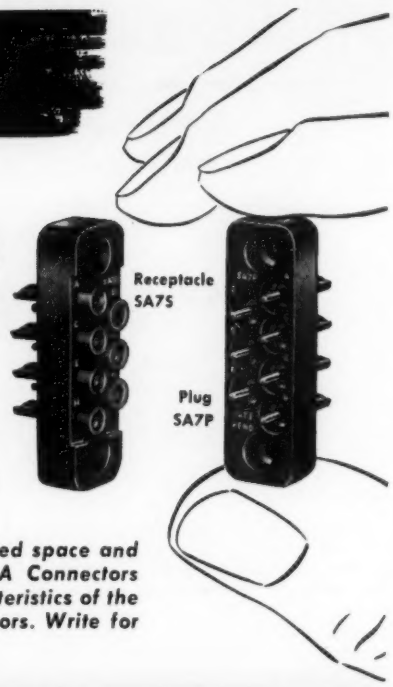

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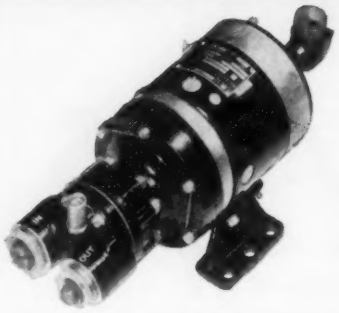

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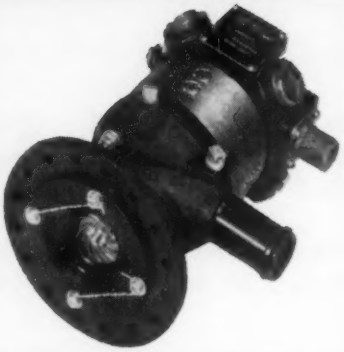

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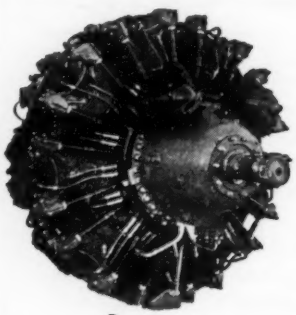

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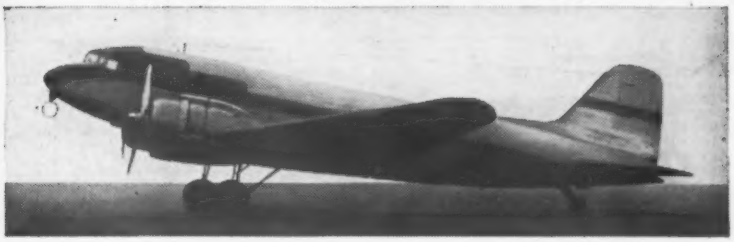

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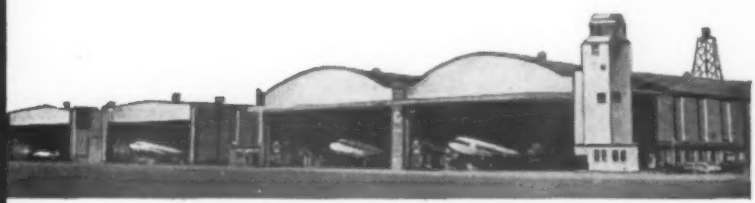

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Drive for Larger USAF Opened

Air Force's Chief of Staff, Gen. Hoyt Vandenberg last week opened the way for Senators to launch a drive for an all-out build-up of the Air Force—probably to 185 groups or more instead of the present target of 95 by mid-1952.

It came during hearings on defense of Western Europe. The issue: should the U.S. participate in a European ground war in an attempt to stave off occupation of the continent by overwhelming Russian troops—if and when they might attack; or, should the U.S. pulverize Russian industry with atomic strategic bombing and then go about the business of liberation?

▶ **First Favored**—The Administration favors the first strategy—largely on the advice of the State Department, sensitive to European political reaction. The military is obliged to support the policy of its commander-in-chief. Reportedly, they consider the second course—being pushed by Republicans, concerned over a big expenditure of American lives in ground fighting—militarily, at least, more sensible.

Vandenberg's opening for more emphasis on airpower was restrained.

Could the war potential of Russia be destroyed by our Air Force? Sen. Kenneth Wherry, Republican leader in the Senate, wanted to know.

The air chief's reply: "with an adequate USAF, properly manned, with sufficient personnel and bases, the war potential of any nation of the world could be destroyed by that air force."

Wherry: does the U.S. have sufficient airpower to do that?

Vandenberg: "our power is great, it is getting greater every day. It is not as adequate as I would desire it."

At the Senators' request, Vandenberg will confidentially supply a blueprint for a build-up of USAF capable of knocking out Russia in the air. "I want to compare the cost of that program with the cost of a ground war in Europe", Wherry observed.

Action on DO's

Private and executive plane owners will get DO priority for spare parts for the next three months. This is the recommendation to National Production Authority by Air Coordinating Committee.

In the same three-month interim period, DO priorities for 625 new planes may be approved. This is a three months' quota at an annual rate of 2500 private and executive planes annually.

A permanent program to go into effect with the controlled materials plan July 1 is under study by CAA (the claimant), ACC (claimants division), National Production Authority. This will be based on estimates of how many non air carriers can be considered "essential" to mobilization. First on this list are agricultural planes, followed by rescue organizations and executive planes of defense contractors.

2-0-2 Report Due

The Martin 2-0-2 modification board this week should come up with recommendations for changes on the Martin, following intensive study of the plane by more than a dozen specialized working groups.

Some of the inspection work has already led Northwest Airlines, to make changes.

Results so far have indicated that no radical changes are necessary. The inspection is expected to make many small contributions to the plane's efficiency and safety, just as a similar modification board study improved the DC-6 several years ago.

Working group reports were due for submission to the modification board Feb. 22, and the board should make recommendations to the Civil Aeronautics Administrator this week. The administrator will issue: 1. Any mandatory change airworthiness directives that appear called for; 2. Optional change notices; and 3. Operational procedure recommendations.

MORE SABRES FOR USAF ARSENAL

Working outdoors under the glare of floodlights at North American Aviation's Los Angeles plant, production personnel rush output of speedy F-86 Sabre fighters to meet accelerated USAF schedules on the 650-mph. plus fighter. (Wide World photo.)

Our Expanding Industry . . .

Aerojet Corp. expects to employ 1500 by June in the new plant it is building on a 7200-acre site near Sacramento, Calif. The rocket engine manufacturer says the employment figure will reach 2000 by October.

Solar Aircraft Corp. will build a 300,000-sq. ft. plant at Des Moines, near its present plant, as a result of the number of orders and letters of intent it has on hand. Completion of the new plant, with expansion of Solar's San Diego main plant, will give the company a million sq. ft. of plant space. Employment, now 3000, is scheduled to increase to 5000 by the end of 1951. . . .

Garrett Corp. is working on a $600,000 AiResearch plant at Phoenix. When done, it will have 250,000 sq. ft. under one roof at a site adjoining Sky Harbor, the municipal airport. . . .

American Helicopter Co., Manhattan Beach, Calif., has taken over a portion of Falcon Field, Ariz., for experimentation on a pulsejet helicopter. . . .

Rheem Mfg. Co., South Gate, Calif., has signed a contract with Lockheed Aircraft Corp. for the fabrication and assembly of major components of T-33 trainers and F-94 all-weather fighters. Work will be under the direction of Laurance H. Cooper, veteran aircraft executive. . . .

Continental Aviation & Engrg. Corp. has received a $7-million ORC order for Navy helicopter engines, extending an original pilot order received a year ago. The engines will be produced in Detroit. . . .

General Electric Co. will build a plant at Utica, N. Y., to produce electronics equipment. The new works, which will cost $15 million, will employ 2500. GE electronics production has heretofore been centered at the company's Electronics Park, Syracuse. . . .

Honeywell Aero Div. plans to double its aeronautical production facilities by Aug. 1. Minneapolis-Honeywell will build a new one-story factory with 100,000 sq. ft. floor space adjoining its present aeronautical plant in Minneapolis. This is in addition to the three-story structure to house the engineering department which should be fully occupied by mid-April.

NEWS DIGEST

DOMESTIC

Second phase of a detailed study of industrial security measures has been completed by Munitions Board. Survey shows that industry is most concerned with sabotage and air raids. But most security plans were found to exist only on paper.

Ned Root and Richard Bean are joining Lockheed Aircraft Corp. this month as publicity manager and assistant. Root has been managing editor of Air Force Magazine and Bean was publicity manager of Los Angeles Chamber of Commerce. John Guenther continues as Lockheed Eastern publicity representative, with offices in New York, while Maggie Smith will still handle radio, television and export publicity from Burbank.

More than a score of prime USAF contractors in the New York metropolitan area exhibited materiel at the N. Y. AF Procurement Field Office during Feb. 19—Feb. 23 in an attempt to enlist the services of local small business firms interested in subcontracting. The prime contractors possess over 300 contracts totaling over $250 million.

H. J. van der Linde has been promoted to production manager of Ryan Aeronautical Co. Formerly airplane production superintendent, van der Linde has been with Ryan since 1923.

American Airlines has ordered three more 52 passenger DC-6Bs, upping its total for this model to 17. All are to be delivered this year at a total cost of $19 million. AA will use the DC-6Bs additional space for cargo.

William B. Bergen has been promoted to vice president-chief engineer of the Glenn L. Martin Co. Bergen's specialty has been rocketry, pilotless aircraft and missiles.

Flying Tiger Line has started overnight regional airfreight service linking West Coast, Middle West and East Coast cities, a new service added to the carrier's six daily transcontinental schedules. Company is upping its C-46 fleet by 12 more planes, a total of 37. Its business has more than doubled in the past six months.

Raydist—a new radar-like position-indicating system—goes to Wright Field this week for checking the accuracy of development and operational models of ILS, GCA, PAR. Raydist is a new type of super-accurate equipment developed by Hastings Instrument Co., of Newport News. Position error of Raydist is about one foot error for every mile of distance.

FINANCIAL

Pacific Airmotive Corp.: Reports a net income of $543,633 for the year ending Nov. 30, 1950, compared with a loss of $24,962 for the same period in 1949. Gross sales were $13,702,547, a 41 percent increase over the preceding year, and the largest in the company's 22-yr. history.

Bendix Aviation Corp.: Reports a net income for the year ended Sept. 30, 1950 of $16,954,116 compared with $11,086,781 for 1949. Sales totaled $219,419,794 as compared with the previous period's $182,674,462. Aircraft equipment accounted for 49 percent of 1950's sales volume. Employment has jumped 40 percent since the outbreak of the Korean conflict.

Beech Aircraft has completed an agreement with a syndicate of seven banks to borrow $10 million as working funds to handle vastly increased contract schedules. Beech backlog is about $100 million. Firm orders are on hand for about 150 C35 Bonanzas and 36 Twin Beech 18s.

Aluminum Co. of America has increased its indebtedness limit up to an aggregate total of $500 million at any one time. Previous limit was $200 million. Increase was authorized to permit huge expansion program to handle defense requirements.

Aeroquip Corp., Jackson, Mich., reports sales for the quarter ended Dec. 31, 1950 of $2,706,797, with net income of $180,085 after provision for federal income and excess profits taxes. Shipments during January exceeded $1 million.

INTERNATIONAL

Commonwealth Aircraft Corp., Australia, has completed its three-place low-wing trainer prototype, designed for the Royal Australian Air Force. It has a DH Gipsy engine, but a new engine, called the Cicada, is being developed for the production version.

Aer Lingus, the Irish airline, is negotiating with Vickers Armstrongs for purchase of four Viscount 48-60 place turboprop airliners. They are scheduled for service between Dublin and London in 1953.